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97th Congress }
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COMMITTEE PRINT

EUROPEAN REACTIONS TO THE
INTERNATIONAL NUCLEAR FUEL
CYCLE EVALUATION

PREPARED FOR THE
SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERA-
TION, AND GOVERNMENT PROCESSES
OF THE
COMMITTEE ON GOVERNMENTAL AFFAIRS
UNITED STATES SENATE
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EUROPEAN REACTIONS TO THE INTERNATIONAL NUCLEAR FUEL CYCLE EVALUATION

Prepared for the
Senate Committee on Governmental Affairs
Subcommittee on Energy, Nuclear Proliferation and Federal Services

Geoffrey Greenhalgh and Walter Patterson, Consultants
With commentary by
Warren H. Donnelly
Senior Specialist
and
Joseph F. Pilat
Research Assistant
Office of Senior Specialists
August 1981

(III)

LETTERS OF TRANSMITTAL

U.S. SENATE,
COMMITTEE ON GOVERNMENTAL AFFAIRS,
SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION,
AND GOVERNMENT PROCESSES,
Washington, D.C., April 8, 1982.

Hon. WILLIAM V. ROTH, Jr.,
Chairman, Committee on Governmental Affairs,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: I respectfully request that the enclosed study of the International Nuclear Fuel Cycle Evaluation prepared under contract to the Congressional Research Service be issued as a committee print. This report is intended to be of use to the Congress in assessing this major multilateral initiative, and in considering future directions for U.S. nonproliferation law and policy.

Sincerely,

CHARLES H. PERCY,
Chairman.

U.S. SENATE,
COMMITTEE ON GOVERNMENTAL AFFAIRS,
SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION,
AND GOVERNMENT PROCESSES,
Washington, D.C., March 4, 1982.

Hon. CHARLES H. PERCY,
*Chairman, Senate Subcommittee on Energy, Nuclear Proliferation,
and Government Processes, 103 Senate Courts Building, Wash-
ington, D.C.*

DEAR CHUCK: The Congressional Research Service has recently provided me with a report on European reactions to the International Nuclear Fuel Cycle Evaluation (INFCE). The report provides a number of valuable insights into this important U.S. nonproliferation initiative, and I would like to recommend that it be published as a print of the Energy, Nuclear Proliferation, and Government Processes Subcommittee.

As you are well aware, European attitudes regarding the results of INFCE are frequently cited in the on-going debate over possible changes in U.S. nonproliferation policy. This report, which centers on the work of two English CRS contractors, provides valuable background analysis for assessing and understanding the reaction of our European allies to the INFCE exercise. I might point out that the approach taken is a balanced one, inasmuch as one of the CRS contractors speaks from the point of view of the nuclear industry, while the other is a leading critic of nuclear power.

I believe the report will prove an important resource for the entire Congress during our deliberations in the months ahead over possible changes in U.S. nonproliferation law and policy, and I would therefore respectfully request it be issued as a subcommittee print.

Best regards,

Sincerely,

JOHN GLENN,
Ranking Minority Member.

LETTER OF SUBMITTAL

CONGRESSIONAL RESEARCH SERVICE,
THE LIBRARY OF CONGRESS,
Washington, D.C., February 5, 1982.

HON. CHARLES H. PERCY,
Chairman, Subcommittee on Energy, Nuclear Proliferation, and Federal Processes, Committee on Governmental Affairs, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: In keeping with earlier discussions with your staff, we are pleased to submit this analysis of European reactions to the International Nuclear Fuel Cycle Evaluation. It is based largely upon the work of two CRS Consultants. Geoffrey Greenhalgh of England approached INFCE from the viewpoint of the European nuclear industry, while Walter Patterson examined it through the lens of a leading European critic of nuclear power.

Commentary and editing were provided by Dr. Warren H. Donnelly, a CRS Senior Specialist, and his assistant, Joseph F. Pilat. The combined analyses of Greenhalgh and Patterson should provide new and useful insight into thinking abroad about ways and means to prevent the further spread, or proliferation, of nuclear weapons. We hope it can help the Congress in its continuing attention to this troublesome matter.

GILBERT GUDE,
Director.

PREFACE

In response to a request from the then Subcommittee on Energy, Nuclear Proliferation and Federal Services of the Senate Committee on Governmental Affairs, the Congressional Research Service prepared this review of European reactions to the International Nuclear Fuel Cycle Evaluation. The bulk of the work was done by two European consultants under contract to the Service. One was Geoffrey Greenhalgh, whose point of view is generally that of the British nuclear industry. The other was Walter C. Patterson, who is a leading spokesman for the environmental organization, Friends of the Earth, in England, and reflects its perception of nuclear power. This presentation of parallel analyses from consultants with different perspectives is intended to provide a balanced overall approach.

The request grew out of a long standing interest of the Subcommittee in the relation between nuclear power and the spread, or proliferation, of the ability to make nuclear weapons. This interest led to the Committee's key role in drafting the Nuclear Non-Proliferation Act of 1978 which, among other things, gave statutory recognition to President Carter's initiation of an International Nuclear Fuel Cycle Evaluation in October 1977.

The CRS originally requested each author to prepare a two-part report. Part I was to provide:

- An overview of the principal effects on government policies, nuclear industries, concerned organizations, and the public, of the conclusions and observations of INFCE; and

- Highlights of the most important implications for future European and U.S. policies and attitudes on ways to prevent proliferation of nuclear weapons from commercial use of nuclear energy and the possible commercial use of plutonium as a nuclear fuel.

Part II was to provide:

- A detailed review of the reactions to INFCE by the governments of the United Kingdom, France, and West Germany, by Euratom, and by concerned organizations, environmentalist and nuclear critics in particular.

- A discussion of the implications of INFCE for future positions of groups and organizations concerned with nuclear power and its linkage to nuclear weapons.

Mr. Greenhalgh submitted his report in this form.

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Mr. Patterson concluded that the requested analysis would have to be based on certain premises regarding INFCE which to him appeared to be unfounded. With permission of the CRS, he redirected his report to discuss and analyze the state of affairs after INFCE, with particular regard to the United Kingdom and Europe, and to establish why some of the premises implicit in the CRS approach did not appear to hold.

The divergent viewpoints of these authors provides fresh insight into some of the thinking by both proponents and opponents of nuclear power about the linkage between nuclear power and the possible further spread of nuclear weapons, and what to do about it.

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SUMMARY

By Warren H. Donnelly

The International Nuclear Fuel Cycle Evaluation concluded in a massive final plenary conference in February 1980. Called by President Carter in 1977 and authorized by Congress in the Nuclear Non-Proliferation Act of 1978, INFCE became an unprecedented international technology assessment.

INFCE is important for the future of U.S. non-proliferation policy on two counts. First, for the substance of its conclusions and recommendations. Second, for the effect it has had on thinking abroad about the linkage between nuclear power and nuclear weapons and what to do about it.

Its immediate benefits included two years of cooling off for heated relations between the United States and other countries over the new policies of the Carter administration and of the Congress to further limit the possible further spread, or proliferation, of nuclear weapons and the ability to make them. INFCE increased foreign understanding of U.S. fears that evolution of nuclear power towards breeders and towards use of plutonium as a fuel would unacceptably increase proliferation risks, but did not convince other governments to defer or abandon their plans. INFCE won support for more exacting conditions for use of plutonium as a fuel and for further strengthening of international inspection and safeguards to verify national commitments not to seek nuclear weapons. On the other hand, many countries saw its conclusion as affirmation of their existing policies and programs for domestic development of nuclear power and for conditions of nuclear trade.

To get some insight into the effect of INFCE on thinking abroad, the Congressional Research Service commissioned two Europeans to separately analyze this matter. Geoffrey Greenhalgh brought the viewpoint of the European nuclear industry, while Walter Patterson came as a leading nuclear critic. Their work shows little dramatic effect of INFCE upon thinking in Europe, probably because much of what INFCE said was taken as confirmation of the wisdom of policies already held and programs already in progress. INFCE produced no debates in Europe either in or out of government, little public reaction, and little if any, changes in existing policies and undertakings of governments or national nuclear industries. Surprisingly, it received virtually no recognition from environmental and other interests that have employed proliferation risks as one argument against nuclear power. Walter Patterson devoted much of his analysis to seeking an answer for this surprising disinterest.

The question of what all of this means for the future evolution of U.S. non-proliferation policy and for Congressional interest therein provided the reason for this CRS venture. The work of Greenhalgh and Patterson suggests that foreign reactions to INFCE, assuming reactions they saw in Europe are typical of those of other countries, are likely to affect the reception abroad of future U.S. initiatives and negotiations to try and bring more countries into line with our ideas about the risks of proliferation and our policies to prevent it. The European reactions to INFCE suggest that in the future the United States will find abroad:

- Greater understanding of proliferation risks;
- A greater tendency to rely upon political rather than technological measures;
- Continued development of the breeder;
- Support for the ultimate use of plutonium as a fuel with attendant reprocessing, but probably not in conventional power plants for many years.
- Support for uniform controls for nuclear exports, but not including all U.S. conditions;
- Pressure on the United States to be a more reliable nuclear supplier;
- Pressure on the United States to negotiate for the new conditions that it may want rather than to present non-negotiable requirements for continued nuclear exports and cooperation;
- A limited acceptance of institutional ways to limit proliferation risks; and
- A more optimistic outlook for nuclear energy than that of the Carter administration.

PART I: BACKGROUND

Warren H. Donnelly
Senior Specialist
January 1981

CHAPTER 1: INFCE, ITS ORIGINS AND PRODUCT

Purpose of this analysis

The purpose of this CRS report is to describe the European reactions to the International Nuclear Fuel Cycle Evaluation, which concluded in February 1980. The description draws upon two principal sources: a review by Geoffrey Greenhalgh who for many years has been active in the European nuclear industry; and a review by Walter Patterson, one of the most articulate spokesmen for the environmental movement in the United Kingdom. This set of analyses from different perspectives revealed a divergence in views far greater than anticipated at the outset of this venture.

Now that INFCE is concluded, it is reasonable to expect that the reactions of other governments and of the public abroad to INFCE's final conclusions and observations will have some influence upon the future evolution of U.S. policy, which is likely to receive fresh Congressional attention after the Comptroller General submits to Congress a three year appraisal of the effects of the Act. It is hoped that this analysis of the European reaction to INFCE will provide useful insight for this anticipated Congressional attention to the overall effects of this international assessment and its implications for the future of U.S. nonproliferation policy.

INFCE's background

President Carter's statements and expectations.--On April 7, 1977, early in his presidency, President Carter issued his statement on nuclear power policy. He announced that the United States would continue discussions with supplying and with recipient nations of a wide range of international approaches to permit all nations to achieve their energy objectives while reducing the spread of nuclear explosive capability. As for INFCE, he said: 1/

... we will explore the establishment of an international nuclear fuel cycle evaluation program aimed at developing alternative fuel cycles and a variety of international and U.S. measures to assure access to nuclear fuel supplies and spent fuel storage for nations sharing common non-proliferation objectives.

1/ U.S. President. Nuclear power policy. Remarks announcing his decisions following a review of U.S. policy and a question and answer session with reporters. April 7, 1977. Weekly compilation of presidential documents, April 11, 1977, p. 507.

In his informal remarks, he added that the United States was not trying to impose its will on those nations that already had reprocessing plants in operation. 2/

Subsequently at the INFCE organizing conference in Washington on October 19, 1977, President Carter further elaborated his thinking. The challenge he put to the conference was to find a means by which the consuming nations who need atomic power to produce electricity can do so and to "draw a distinction between that need, which is legitimate, and the threat of the development of atomic explosions themselves." He was pessimistic about the utility of nuclear power, saying: 3/

I have a feeling that the need for atomic power itself for peaceful uses has perhaps been greatly exaggerated. And I hope that all nations represented here and others will assess alternatives to turning to this source of power if for no other reasons than because of economic considerations.

As for what President Carter hoped for from INFCE, he was quite specific, saying: 4/

It's important that we know what potential nuclear fuel cycles are available to us, the quantity and the location of uranium and thorium and other nuclear fuels, the methods used for extraction, the methods used and the costs for enrichment, possible distribution systems, the proper design and use, standardization of powerplants, safety of people who live near them, proper siting considerations, the political objections to atomic powerplants themselves, the possible need for breeder reactors, the handling of spent fuel, the need or absence of a need for reprocessing the spent fuel, and international safeguards that will prevent the development of explosives.

We are eager to cooperate as a nation which is a consumer and also a supplier. We want to be sure that where there is a legitimate need and where there's a mutually agreed upon nonproliferation restraint, that there be an adequate supply of nuclear fuel.

After INFCE had been completed, Ambassador Gerard Smith in an appearance before Congress recalled that the impetus for it had come from serious questions and concerns of the Carter administration about assumptions that economic and resource considerations required early deployment of plutonium cycles (both thermal recycle and breeders) and that existing safeguards and controls would

2/ Ibid., p. 504.

3/ U.S. President. International Nuclear Fuel Cycle Evaluation. Remarks at the first plenary session of the organizing conference. October 19, 1977. Weekly compilation of presidential documents, October 24, 1977, p. 1567.

4/ Ibid.

be sufficient to control the proliferation risks. ^{5/} So INFCE was designed primarily to gain time for the administration to examine such questions, to foster a better international appreciation of the energy and non-proliferation implications of nuclear fuel cycle choices, and perhaps seek new arrangements to control proliferation. The administration was particularly concerned over plans by some countries to acquire facilities for reprocessing and enrichment when they had no visible technical or economic need for them, and the possibility of early commercial use of plutonium for recycle in conventional reactors. INFCE also was to provide a forum for open discussion of nuclear power and non-proliferation issues which had become increasingly contentious, particularly at the IAEA and in the United Nations.

INFCE's organizing conference.--The organizing conference in October 1977 established the method of work and defined the scope of the study, dividing it among eight working groups each of which corresponded to a part of the nuclear fuel cycle as shown in Table I. Subsequently, these working groups held 61 meetings during the two years of the study.

Two early decisions of fundamental importance were made. First, INFCE was to be a technical and analytical evaluation, not a political negotiation, and its results were not to be binding. The evaluation was to be carried out in a "spirit of objectivity" with mutual respect for each country's choices and decisions, without jeopardizing their respective fuel cycle policies or international cooperation, agreements and contracts provided that agreed safeguards measures are applied. The avoidance of political questions merits some further comment, for INFCE's proceedings bore all of the signs of an intensely political process with long negotiations and struggles over shades of meaning and inclusion of limiting and qualifying statements. Subsequently Professor Abram Chayes, who chaired INFCE's Technical Coordination Committee and drafted the INFCE summary report, commented on this as follows: ^{6/}

The people who participated in the study were not naive. They knew that there is no such thing as a "purely" technical question, in this context, and that such matters as uranium reserves and nuclear power demand are more likely to be negotiated than estimated. Nevertheless, the formula had the effect of insulating the deliberations from the grosser forms of political pressure and it set a standard of balanced, professional analysis to which all could be recalled when the discussion got heated. Moreover, it meant that the outcome of the study could not be normative or directive. No country's policy or program could be approved or disapproved. The study was to state what could be said on all sides of a participation question.

^{5/} Gerard Smith. Statement before the Subcommittee on Energy Research and Production, House Committee on Science and Technology, June 4, 1980.

^{6/} Abram Chayes. Remarks at a Conference of the Atomic Industrial Forum, New Orleans, La., Apr. 16, 1980.

TABLE I
List of INFCE Working Groups

Working Group Number	Technical and Economic Scope	Cochairing States
1	Fuel and heavy water availability	Canada, Egypt, India
2	Enrichment availability	France, West Germany, Iran
3	Assurances of long-term supply of technology, fuel and heavy water and services in the interest of national needs consistent with non-proliferation	Australia, Philippines, Switzerland
4	Reprocessing, plutonium handling, recycle	Japan, United Kingdom
5	Fast breeders	Belgium, Italy, USSR
6	Spent fuel management	Argentina, Spain
7	Waste management and disposal	Finland, Netherlands, Sweden
8	Advanced fuel cycle and reactor concepts	South Korea, Romania, United States

The second important decision was to open INFCE to all nations, which permitted participation by many states not party to the Nuclear Non-Proliferation Treaty, such as India and Pakistan. By the time of INFCE's concluding plenary conference in February 1980, more than 60 countries had taken part plus several international organizations.

INFCE's statutory basis.--President Carter included a provision for INFCE in the draft bill that he sent to Congress on April 27, 1977. As enacted on March 10, 1978, the Nuclear Non-Proliferation Act, P.L. 95-242, directed the President to take:

. . . immediate initiatives to invite all nuclear supplier and recipient nations to reevaluate all aspects of the nuclear fuel cycle, with emphasis on alternatives to an economy based on the separation of pure plutonium or the presence of high enriched uranium, methods to deal with spent fuel storage, and methods to improve the safeguards for existing nuclear technology.

INFCE's product.--INFCE's final product was a plenary conference in February 1980, held in Vienna, Austria, which is the home of the International Atomic Energy Agency, and a summary report plus individual reports of its eight working groups. Each report expressed a consensus. To accommodate many divergent views, INFCE's report includes many qualifications for its statements and conclusions. As a result, many differing interests can find some support for their positions in INFCE.

The reports were printed by the International Atomic Energy Agency and can be purchased from it. While copies were provided to governments and the nuclear industries, there was no reprinting in various countries of copies for public information.

CHAPTER 2: THE CARTER ADMINISTRATION'S ASSESSMENT OF INFCE

The European reaction to the International Nuclear Fuel Cycle Evaluation has inevitable implications for the future course of U.S. policies to prevent the use of nuclear power from increasing the risks of the further spread of nuclear weapons and explosives, and the ability to make them. To set the stage for examination of European reactions to INFCE, it will first be profitable to consider the reactions of the Carter administration. A good indication of this is to be found in the statements in June 1980 by Ambassador Gerard Smith, who was President Carter's special representative for non-proliferation matters, and Dr. George W. Rathjens, his deputy, before a Congressional committee. ^{7/} The tone of their statements was optimistic as to INFCE's achievements, although for some matters it was clear that INFCE had not produced all of the hoped for results. Much of their combined testimony focused on one or another aspect of prospective production and use of plutonium as a nuclear fuel, which U.S. policy seeks to discourage. Highlights of their testimony included the following:

INFCE's consensus and its implications.--Although INFCE's conclusions and observations were extensively qualified so that divergent views could be accommodated within consensus, INFCE had narrowed differences among participants over such matters as terminal waste disposal, sources of proliferation risks, and the availability of uranium. So future differences are more likely to be over matters of judgment rather than of fact. However, the INFCE consensus of itself would not provide a basis to resolve outstanding issues in international nuclear energy policy because it had failed to reach agreement on some questions, did not treat other questions adequately and some not at all.

Effect on U.S. policies to date.--INFCE was not expected to resolve outstanding issues or cause changes in nuclear programs of other countries or to modify U.S. policies of concern abroad. In particular, INFCE produced no data or analysis that substantially changed U.S. perceptions about the potential role or reasonable time scales for the various nuclear fuel cycles in the United States.

Perception of proliferation risks.--Dr. Rathjens and Ambassador Smith differed in their view of INFCE's treatment of proliferation risks. Ambassador Smith saw INFCE as tending to discredit over-simplifications and over-generalizations in proliferation risk analysis, as well as in economic and

^{7/} Statements of Gerard Smith and George W. Rathjens before the Subcommittee on Energy Research and Production, House Committee on Science and Technology, June 4, 1980.

technical analysis. While INFCE held that acceptable proliferation resistance could be obtained with once through systems, it was made clear that this depends very much upon how enrichment is handled. Proliferation risks of enrichment were recognized by INFCE as was the importance of minimizing the number of enrichment plants and putting them in stable and safe locations. From Rathjens viewpoint, INFCE was unable to get general agreement on the relative proliferation risks of different reactors and their fuel cycles, although the risks for the sensitive stages of enrichment and reprocessing were clearly identified.

INFCE and plutonium.--Both Ambassador Smith and Dr. Rathjens focused on what INFCE had to say about the use of plutonium in thermal reactors and in breeders, which was opposed by the Carter administration's policy of no-plutonium now. Dr. Rathjens commented on INFCE's treatment of three principal motivations for the production and use of plutonium as a nuclear fuel [the so called plutonium economy], which included the benefits seen in use of plutonium in thermal reactors (recycle), in development and use of breeders, and in reprocessing as a key step in disposal or management of spent fuel discharged from nuclear power plants.

Concerning plutonium recycle, the INFCE consensus that its economic advantage, if any, would be small was an important finding consistent with the views of the administration. However, not all INFCE participants agreed that recycling should be avoided or delayed. So the limited benefits of INFCE in the United States on this point were to reduce contention in future consideration of economic aspects, to emphasize consideration of safeguards in the design of reprocessing plants, and to recognize the advantages of a new, large, multi-national reprocessing facilities.

For the breeder, a welcomed INFCE observation was that breeders are unlikely to be attractive in nations lacking a substantial technical base or having only small electric grids. However, the administration did not share INFCE's clear support for early deployment of breeders. This difference was ascribable to differing views about the prospects for assured access to adequate supplies of uranium for conventional nuclear power plants.

For waste disposal and reprocessing, INFCE's conclusions were generally consistent with the U.S. position that there is little, if any, economic or environmental advantage to reprocessing spent fuel as a step in waste management. However, there was no INFCE agreement that spent fuel should be disposed of irretrievably so that its plutonium could not be recovered in the future. Of this Rathjens remarked: "No nation with a major program is yet prepared to throw away the energy values inherent in the plutonium in spent fuel." Moreover, and not withstanding INFCE's work, there were no solutions for spent fuel storage in sight because of political problems--which INFCE could not reasonably address.

Ambassador Smith noted that INFCE's conclusions about use of plutonium, while mixed, meant that all countries should consider the risks, economic costs and technical complexities of plutonium cycles, and not simply assume such cycles appropriate for all situations. In those situations where there may be a net benefit from use of plutonium, there was broad INFCE agreement that serious work should be done to improve safeguards, minimize the presence of separated plutonium, and provide international oversight for its storage.

On the whole, from the administration's viewpoint, several INFCE conclusions bearing on the use of plutonium were supportive of U.S. policy, but INFCE did not support general acceptance of that policy.

Nuclear fuel supply and demand.--Dr. Rathjens noted the Carter administration's view that the United States would have assured access to enough uranium and enrichment services so that domestic use of breeders could be deferred well into the next century, and that a similar conclusion could be reached for the world as a whole if one looked at demand for nuclear power and availability of uranium and enrichment in aggregate. The administration considered INFCE's projections for nuclear power to be excessively optimistic and had argued in INFCE, without success, for downward revision. The administration was more successful in getting INFCE agreement on what it believed to be acceptable projections for the availability of enrichment and the producibility of uranium. On the whole, the INFCE projections of supply and demand provided uncertain indicators for the urgency of breeder development, and could be used either to support getting on with the breeder, or to delay it. Having said this, Rathjens conceded that INFCE's analyses of supply and demand might not be determinative for national decisions on the breeder because some governments are skeptical of analyses based on supply and demand for the world as a whole. This uncertainty emphasized for the administration the importance of consensus on mechanisms in which nations can have confidence for assuring access to uranium and to enrichment. Here Rathjens spoke of a fundamental dilemma for the United States:

. . . Our policy and our law require that we condition our supply of fuel and technology on others accepting U.S. approval rights over the use of U.S. origin materials. Yet, the imposition by us of conditions on supply necessarily reduces the confidence of others that they will have access to fuel and technology.

Technological options.--One INFCE finding was seen by the administration as sufficient for a consensus on policy. This was agreement that for the most part, highly enriched uranium in research reactors could be replaced with less enriched uranium. This was one of the elements of President Carter's nuclear policy of April 7, 1977.

Since much of the administration's non-proliferation policy has emphasized technological developments to reduce the need for plutonium as a fuel, INFCE's observations on related technological matters were commented upon by Rathjens.

Beginning at the front end of the nuclear fuel cycle, INFCE looked at different enrichment technologies and produced a consensus that large multinational endeavors would have an advantage over small, dispersed national facilities from both economic and non-proliferation perspectives. INFCE strongly supported use of light and heavy water thermal reactors, and the liquid metal fast breeder. There was little support in INFCE for other advanced reactors proposed by the United States. As noted earlier, it was impossible to get agreement on the relative proliferation risks of different nuclear fuel cycles. As for U.S. proposals to reduce uranium consumption in thermal reactors, most INFCE participants accepted the U.S. goal for an initial 15 percent improvement, but felt the United States was overly optimistic about the additional 15 percent increase postulated by the administration.

There was consensus that some modifications in reprocessing and fabrication of fuel containing plutonium could reduce the risk of theft of weapons-usable materials by terrorist or other subnational groups. However, INFCE concluded that neither these technical options nor the use of fuel cycles based upon thorium and uranium-233 would offer significantly increased resistance to diversion of nuclear materials by governments. In other words, INFCE did not come up with promising technical fixes to the reprocessing problem.

PART II: EUROPEAN REACTIONS TO INFCE

Geoffrey Greenhalgh
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CHAPTER 1: OVERVIEW

Proliferation as a political problem

The most significant conclusion to emerge from INFCE was that preventing further proliferation of nuclear weapons is primarily a political problem. It was recognized from the outset that INFCE was to be a technical evaluation. Its completion has provided a common factual background, a solid agreed data base on which political decisions can be taken. Contrary to some initial hopes, notably by President Carter, that INFCE would find options and alternatives to reprocessing and recycle that have been overlooked or forgotten, the agreed consensus was that there is no technical fix, no magic fuel cycle that would be inherently proliferation proof. The Canadian delegate said of INFCE's outcome: 8/

We have concluded that there is no nuclear fuel cycle which is wholly proliferation proof. Conversely, we have also concluded that there is no nuclear fuel cycle which cannot be reconciled with the need to avoid proliferation.

If the politicians had hoped to pass the problem to the technologists, they were disappointed for the technologist passed the problem firmly back to them.

As for the future, INFCE can be expected to have some influence. This point was made by the Japanese delegate at INFCE's final plenary conference, who said of INFCE: 9/

While its results are not directly binding on any participating government, there seems to be little doubt that INFCE's conclusions are bound to be taken into account in one way or another in bilateral and multilateral negotiations in the coming years and have no small impact on the direction of such negotiations.

There can then be little doubt that the conclusions of INFCE will be frequently and forcibly represented in the coming years, particularly on questions of the availability, security and stability of uranium supply; on reprocessing, which INFCE characterized as the essential preliminary to many of the possible fuel cycles 10/; and on plutonium recycle in thermal and fast reactors.

8/ Statement of Canadian delegate at the final INFCE plenary conference, Vienna, February 1980.

9/ Statement of Japanese delegate at the final INFCE plenary conference.

10/ INFCE, Summary volume, op. cit., p. 18.

Nuclear power as an inalienable right.

But INFCE was not solely concerned with the danger of the proliferation on nuclear weapons. The Final Communique of the organizing conference in Washington, October 1977, accepted that nuclear energy should be made widely available to meet the urgent needs of the world's energy requirement, and in this, recognized that special consideration should be given to the developing countries. By their participation in the work of INFCE over a two year period most countries, and in particular the developing countries, have come to look upon these aims as rights, as reflected in INFCE's conclusion that: 11/

The use of nuclear power for economic and social development has been considered an inalienable right of all countries and a viable electricity supply option in a number of developing countries.

This view was emphasized at the final plenary conference by the Turkish delegate who said: "The production of nuclear energy through all practical strategies is inter alia, one of the inalienable rights of any country." It was repeated by the Pakistan delegate, who said:

. . . since we started INFCE two years ago the energy crisis has deepened and the need for using nuclear power was never more urgent than now. Nuclear energy with all its complexities has become an inescapable fact of life for our economic survival.

This, indeed, was the clear message from the declaration of the earlier Conference of Non-Aligned Countries in Havana, September 1970, which said: 12/

The Conference affirmed the inalienable right of all States to apply and develop their programmes for the peaceful uses of nuclear energy for economic and social development in conformity with their priorities, interests and needs. It deplored the pressures and threats against developing countries aimed at preventing them from pursuing their programmes for the development of nuclear energy for peaceful purposes.

All states should have unhindered access to and be free to acquire technology equipment and materials on a non-discriminatory basis for peaceful uses of nuclear energy, taking into account the particular needs of the developing countries.

The Conference stressed the need for observance of principles of non-discrimination and free access to nuclear technology and reaffirmed the right of each country to develop programmes for the use of nuclear energy for peaceful purposes in conformity with their own freely determined priorities and needs.

11/ Ibid., p. 49

12/ Conference of Heads of State or Governments of Non-Aligned Countries, Havana, September 3-7, 1979. Final declaration, par. 213, 214, 217.

No discrimination in nuclear supply.

If the expectations awakened by INFCE are frustrated, it must lead to widespread resentment and charges of discrimination. Such a reaction will not be limited to the developing countries. For example, the Commission of the European Communities commented to its council that: 13/

The concerns in Europe are also directed more towards reliability of supply and non-discrimination in the peaceful uses of nuclear energy. And here it has been noted by the EEC that INFCE has not succeeded in "allaying fears that trade in the nuclear sector would continue to be distorted or even disrupted, by the unilateral action of certain governments. . . the risk that certain technologies (for example, plutonium recycling in thermal reactors) would be subject to discriminatory treatment is still with us."

The agreed conclusions of INFCE can, and no doubt will, be taken as legitimizing all peaceful nuclear activities, as the West Germans made clear in their comment that: 14/

It will not be possible to restrict the use of nuclear energy to one specific fuel cycle . . . it is not possible to reach any general judgement as to whether one particular fuel cycle entails more risks of proliferation than another. Every country will still have to make its own decisions on the peaceful use of nuclear energy taking into account the respective technical, ecological, economic, political and financial circumstances.

This is a reaction not solely against the U.S. policies as set out in the Nuclear Non-Proliferation Act. Fears were also expressed by Belgium and Switzerland lest the nuclear weapon states extend their privileged position into the peaceful uses of nuclear power. The Swiss delegate warned that: 15/

The renunciation of nuclear weapons should be made more attractive: there should be compensation in other areas for a state which has adhered to NPT, and this was the purpose of articles IV and VI of the Treaty. But now there is a tendency to add to the discrimination that already exists between the weapon and non-weapon states by other discriminatory measures in the peaceful uses of nuclear power.

13/ Commission of the European Communities. Report from the Commission to the Council on the International Nuclear Fuel Cycle Evaluation, 1980.

14/ Statement of the FRG delegate at the final INFCE plenary conference.

15/ Statement of the Swiss delegate at the final INFCE plenary conference.

There was also dissatisfaction with the restrictions imposed by the informal "London Club" of nuclear supplier states. ^{16/} The case against such discriminatory policies was spelled out by INFCE Working Group 3: ^{17/}

Assurance of supply and assurance of non-proliferation are thus complementary. Not only do effective non-proliferation assurances facilitate supply assurance but the non-proliferation commitments of any country may be considered stronger to the extent that such a country relies on international markets for a part of its nuclear supplies. Assurance of supply could also reduce pressures for a world-wide spread of enrichment and reprocessing facilities, even though these may be ultimately required to meet national needs.

The same view was expressed by the International Consultative Group on Nuclear Energy, sponsored jointly by the Royal Institute of International Affairs, London, and the Rockefeller Foundation, New York which early in 1980 called for: ^{18/}

A new bargain of confidence in which credible guarantees of peaceful purpose will be balanced by firm assurances of access to nuclear services, materials and technology.

Concern over reliability of uranium supply.

For the industrial countries of Europe, the main concern was about the availability and reliability of supplies of uranium - "the most political of all commodities." ^{19/} In the short term this calls for clear, unambiguous rules to govern the supply of nuclear material equipment and technology. INFCE Working Group 3 argued strongly for greater predictability in nuclear commerce, and for the reduction of uncertainty in the application of controls over exports, and in some cases imports. Subsequently, the Uranium Institute warned that a "case-by-case consent is not the most effective approach to promoting non-proliferation objectives." ^{20/} One INFCE response was a move, promoted by the

^{16/} The London club was formed originally in 1976 by United States, USSR, United Kingdom, France, Canada, Japan, Federal Republic of Germany, and with the subsequent addition of German Democratic Republic, Poland, Czechoslovakia, Belgium, Netherlands, Italy, Sweden and Switzerland.

^{17/} INFCE. Assurances of long-term supply. Report of Working Group 3, p. 4.

^{18/} Report of the International Consultative Group on Nuclear Energy January 17, 1980, p. 21.

^{19/} So termed by the British delegate at the final INFCE Plenary Conference, February 1980.

^{20/} The International Fuel Cycle Evaluation Report: Initial comments by the Uranium Institute, March 1980, p. 7.

British, and French with support from other European countries, for a further study by an expert group under the IAEA to follow up the report of INFCE Working Group 3 and to try to formulate an internationally acceptable set of rules under which supplies of nuclear material, equipment and technology, and fuel cycle services can be assured on a more predictable and long-term basis in accordance with mutually acceptable considerations of non-proliferation. This was accepted by the IAEA Board of Governors in June, 1980 and is the basis for the new Committee on Assurances of Supply. In the medium term, some countries, notably Belgium and Switzerland, pointed to 30 percent savings in uranium that can be gained as reason that they may wish to recycle plutonium in thermal reactors, especially if uranium supply remains subject to potential interruption. INFCE Working Group 4 noted that for some countries without indigenous uranium supplies recycle could contribute to energy independence and assurance of supply. 21/

In the longer term, the ultimate goal is the introduction of the fast breeder reactor where, as seen by INFCE: a power system of fast reactors with an adequate breeding gain could provide freedom from uranium supply constraints over a period of many hundreds of years. 22/

For the European countries increasingly dependent on nuclear power but lacking any rich indigenous uranium resources, the lure of independence offered by the fast reactor is irresistible. And this is now backed with the added approbation of INFCE that in comparison with the LWR fuel cycle, the FBR fuel cycle appears to confirm and to enhance the advantages of nuclear power to both the environment and the population.

INFCE as a turning point.

INFCE has then been seen as a turning point in the course of world nuclear energy development, but it is not clear what the new direction will be. The English analyst, Ian Smart shows two divergent nuclear futures: 23/

On one side, there is a model of development in which countries committed to nuclear energy programmes, but unconvinced that essential goods and services will always be available on acceptable terms, are driven to seek nuclear autarky as the only route to energy security. With little regard to cost, more of them will then for instance, acquire their own plants for enrichment and reprocessing.

21/ Summary volume, op. cit., p. 18.

22/ INFCE: Fast breeders. Report of Working Group 5. 1980, p. 71, 78.

23/ Ian Smart. Nature. vol. 283. Feb. 28, 1980, p. 809.

On the other side is a model of interdependent development in which the same countries, offered a reliable system of nuclear trade and co-operation, will voluntarily optimise their programmes within a regional or global context. Political and economic rationality will then coincide to produce an efficient international distribution of labor in the nuclear fuel cycle, including its sensitive stages.

International plutonium storage.

A step towards the path of interdependent development was taken by the general welcome given by all countries at the INFCE Final Plenary Conference to study of proposals to establish an international plutonium storage scheme. The British delegate said it promised: 24/

A reinforcement of the safeguards which will ensure greater confidence against the potential misuse of plutonium . . . it will provide an internationally accepted system for the storage and use of plutonium specific enough in its provisions to replace much of the present complex of supplier controls. In this way IPS would both reduce the risk of misuse of plutonium and provide greater assurance in the eventual supply of plutonium to those whose civil programmes require it.

The IPS study was started before INFCE by an expert group working within the IAEA on the basis of Article XII of the IAEA statute which gives the Agency the right to require the deposit with it of any excess plutonium so as to prevent stock-piling, provided that it shall be promptly returned for peaceful uses under IAEA safeguards. As INFCE noted, such a scheme would be relevant whether or not most countries decide to reprocess their spent fuel since separated plutonium already exists in the world and some countries have definite plans to continue to introduce reprocessing. 25/

Plutonium buy-back.

At present, spent fuel could be considered either as an asset or a liability, depending upon non-proliferation policies. For countries considering stockpiling and possible final disposal of spent fuel into a repository, costs will be incurred and the spent fuel with its contained plutonium would be a liability. On the other hand, those countries that have invested in reprocessing and plutonium facilities and whose energy policy involves the use of plutonium would consider it an asset. This led INFCE to consider the idea of a "plutonium credit" whereby the title to plutonium in spent fuel or recovered by reprocessing could pass from one country to another, or to an international venture in return

24/ Statement of the British delegate at the final INFCE Plenary Conference.

25/ INFCE, Summary Volume op. cit., p. 46.

for a credit which could be realized in monetary compensation, or in substitute materials, or in special services or any combination thereof. 26/ According to INFCE Working Group 3: 27/

In the absence of a significant market, the main questions are to define when and to what extent the depositor would be compensated for the energy content of his spent fuel. This raises the critical problem of knowing the future value of plutonium and knowing which country or group of countries would be prepared to bear the financial risks of providing plutonium credits.

This concept was developed further after INFCE by Dr. Walter Marshall of the United Kingdom Atomic Energy Authority who foresaw that the rapid and early introduction of fast reactors would not be possible because the plutonium would not be available to launch more than a few, and the slow breeding characteristics of fast reactors would prevent rapid expansion of their use. As for getting the plutonium needed to move quickly into breeders, Marshall said: 28/

The fast reactor countries then have an incentive to trade with other countries producing, but not intending to use, spent thermal reactor fuel in order to be able to turn this material to good account.

This mutual economic benefit, which is a natural consequence of international trade in spent thermal fuel, also assists an international non-proliferation regime because it concentrates, on a voluntary basis, fast reactors and plutonium in a limited number of countries A fair trade can produce equal economic benefits to the participants. Those countries operating fast reactors would have the advantage of being able to install them more rapidly.

Countries operating thermal reactors would be protected from increasing uranium prices by the payment they would receive for their spent fuel exports and would then have no incentive to embark quickly upon a fast reactor programme; this could be introduced in a more gradual and evolutionary manner in due time.

International spent fuel storage.

A second international initiative endorsed by INFCE Working Group 7 was for international spent fuel management which could offer economic and management advantages and hence strengthen non-proliferation. Central facilities for the disposal of spent fuel and/or vitrified waste would alleviate the concerns of countries with small nuclear programmes and reduce the risk of diversion. This topic is also now being studied by another expert group of the IAEA.

26/ INFCE: Working Group 3. Report. op. cit., p. 83.

27/ Ibid., p. 84.

28/ Walter Marshall. Plutonium breeds unity. New scientist, v. 85, Mar. 6, 1980, p. 730.

Nuclear supply assurances.

Concerns about proliferation caused by use of breeders are lessened by INFCE recognition that any large scale reliance on fast reactors will be limited by technological and industrial prerequisites to a few industrial countries for some time into the future. The immediate problem is the supply of materials, services and equipment where the greater number of countries are concerned about uranium supplies. This, as noted above, is the subject of an expert group study to be taken up within the IAEA in extending the ideas of INFCE Working Group 3. A report of the Uranium Institute indicates some areas where, in the industry's view, progress could be made. 29/ These suggest that some case-by-case action on controls over uranium supply with all the uncertainty and unpredictability that they involve could be dropped. If necessary an agreement on consent could be arrived at before any firm contract is entered into.

In the same way, prior-consent requirements for re-exports or retransfers could be determined under an automatic provision which would enable any holder of fuel to transfer it to another country which had accepted rules identical to those required by the original supplier. This could lead to a position whereby natural or low enriched uranium could be freely transferred between all countries accepting IAEA safeguards. If this covered all NPT signatories, it would give a positive incentive to accepting NPT that has hitherto been lacking. At present, however, it is the unpredictable and potentially capricious case-by-case approach which is seen as the main obstacle to a stable uranium market. It could indeed be counter-productive with the probable development in the coming years of surplus capacity for both uranium and enrichment. Consumer governments might eventually react by forbidding their utilities to buy uranium or services from supplier nations that impose unacceptable conditions.

Proliferation is still a political problem.

The conclusions of INFCE were firmly endorsed by the Heads of State at the Venice Summit meeting in June 1980 which included Canada, France, Germany, Italy, Japan, United Kingdom, and United States. Its communique said, in part:

We welcome the findings [of INFCE] with respect to increasing predictable supplies, the most effective utilization of uranium sources, including the development of advanced technologies, and the minimization of proliferation risks, including support of IAEA safeguards.

But there is wide agreement in Europe that the problems of proliferation are more of a political nature than technical. INFCE was seen as underlining the fact that a government's decision to equip itself with nuclear weapons is essentially political and prompted by reasons of national security, and that the peaceful use of nuclear energy is neither the easiest nor most economic method of manufacturing nuclear weapons.

29/ The International Fuel Cycle Evaluation Report, Initial comments by the Uranium Institute. London, March 1980, pp. 12-13.

INFCE is seen in Europe as having provided a wider and better understanding of the problems of proliferation. In particular, it has given an impetus to three useful initiatives: the international plutonium storage scheme, the international storage of spent fuel and or waste, and the proposal to work out an acceptable international set of rules for assurance of essential nuclear supplies. But all three can only operate within the NPT and its associated safeguards. It is where safeguards stop that the risk of proliferation begins. This was the message of David Fischer, then Assistant Director General for External Relations of the IAEA, who said: 30/

Plutonium storage can provide useful assurances that plutonium is only released for bona fide purposes, and that surplus plutonium is kept in international custody. Storage and management of spent fuel seems to be an urgent technical problem rather than a non-proliferation concept. Re-establishment of confidence in supply commitments can help to reduce commercial incentives to build new national reprocessing or enrichment plants. All three concepts, however, are essentially designed to keep temptation away from the virtuous rather than to claim or to reclaim those who have not yet entered into the fold.

To put it more bluntly, it is difficult to see how any new international concepts or institutions will change the mind of those countries in the Middle East, South Asia and Southern Africa that for political reasons have chosen to keep open the option of making nuclear weapons. In these cases, we must look to bilateral diplomacy and to solutions that are specific to the problems of the countries or areas concerned rather than to new universal remedies, such as new pieces of international machinery.

30/ David A. V. Fischer. Address. American Nuclear Society Conference on International Nuclear Commerce, September 1979.

CHAPTER 2: EUROPEAN REACTIONS TO INFCE

A victory or defeat for the United States?

There has always been a tendency to regard INFCE in gladiatorial terms with the United States against the other participants. A belief that the whole purpose of the exercise was to justify the U.S. policy of no-reprocessing and no-fast breeder was seen by some to be implicit in President Carter's expectation that INFCE was to seek "options and alternatives to reprocessing and recycle that have been long overlooked or forgotten". Even before the start of INFCE, the Friends of the Earth argued, in the summer of 1977 at the Windscale Inquiry, that the whole point of INFCE was "to try and find a cycle which will not in the end result in separated plutonium". This over simplified view was rejected by Mr. Herzig of the U.K. Department of Energy, who said at the inquiry: 31/

No, the objective is to meet the needs of the world, or those countries in the world who need nuclear energy in such a way as to minimize the risks of proliferation . . . I think that all countries will be entering this study with a view to getting the most comprehensive list of topics and to study them open-mindedly and with a hope of arriving at some arrangements which will produce not only a fresh evaluation of proliferation risks, but also some suggestions of how proliferation risks can be reduced

Despite this official view, there was at the beginning of INFCE a widespread scepticism that it could produce a neat technological solution, a "quick fix" to employ the term so often used by the American nuclear scientist, Dr. Alvin Weinberg. At the outset the solution was seen as more political than technological. Of this Sir John Hill said to the IAEA in September 1977, that: 32/

There is no simple technical solution . . . there is no magic fuel cycle . . . non-proliferation is finally a political problem and the basic solution must equally be political.

This view was to be endorsed by INFCE itself and was echoed two and a half years later in an assessment of INFCE by Sir Hermann Bondi, chief scientist of the British Department of Energy, in his article, entitled "No Technical Fix to a Political Problem" of June 1980. 33/

31/ Windscale Inquiry. Day 43, p. 5.

32/ Statement to the General Conference of the International Atomic Energy Agency, Vienna, September 1977.

33/ Hermann Bondi. No technical fix to a political problem. *Nature*, vol. 284, March 6, 1980, pp. 7, 8.

Viewed in these terms, some commentators saw the outcome of INFCE as a defeat for the United States. The Financial Times of 25th February, 1980 under the headline "Opposition to U.S. Nuclear Plans," observed that the participating nations had "... refused to endorse U.S. Government policies for control of nuclear proliferation." The Observer, working from an early leak, claimed on 27th January, 1980 "Report hits Carter's nuclear waste policy." From Italy, the Corriere della Sera, 1st March, 1980 reported "Carter beaten: 500 experts say 'yes' to plutonium power stations".

These are however extreme views, and reflect the problem of the journalist seeking to dramatize a two year, highly complex technical and exhaustive study which has been described as the most comprehensive evaluation of a technology ever undertaken. The summary report, with the eight reports from the INFCE working groups, some 1,500 pages in all, has not lent itself readily to instant comment. And since there was an agreed final report with no head-on confrontations between the participants, the press reaction has been muted and even confused. At one extreme, an article in Nature, 28th February, 1980, by Ian Smart claimed that "INFCE brings international agreement on nuclear fuel cycle no nearer," while the Swiss Neue Zürcher Zeitung on 29th February, 1980 headlined its report "International Approach in Nuclear Power Politics". Yet a few days later, a longer, more considered article in the same Swiss paper, 2/3 March, 1980, was headed "Unsolved Problem of Nuclear Power Politics No Patent Recipe for Solving Fuel Cycle Proliferation", while by March 7th the Financial Times had swung back to the headline "World Nuclear Consensus".

For governments too there have been no immediate public announcements. It was agreed at the outset that INFCE should be a technical and analytical study, not a negotiation; the results were for the consideration of governments in developing nuclear energy policies and in international discussions on co-operation, controls and safeguards. Clearly it will take time to digest the full implications of INFCE.

But for many countries it must be considered probable that their reactions to INFCE will be along the lines of the statements made by their delegations at the Final Plenary Conference of 25th February, 1980. One consequence of the desire of all the participating countries to reach agreed conclusions is that INFCE can, and no doubt will, be interpreted as legitimizing almost all peaceful nuclear aspirations.

For example, the official judgement of the Federal Cabinet of the German Federal Government, at the end of April 1980, was quite specific in finding that INFCE confirmed the general thrust of the German national nuclear policy with respect to the "Entsorgung" (the backend of the fuel cycle, i.e. reprocessing and waste management), to the breeder option, and to the German international nuclear policy (integrating the developing countries wishing to develop nuclear energy into a system of co-operation and joint responsibility so as to assure the exclusively peaceful uses of nuclear energy). 34/

34/ Christian Paternmann, Federal Ministry of Research & Technology
 "What did INFCE achieve" AIF/SAFO meeting, Stockholm, June 15-18, 1980.

Effects of dependence on imported uranium.

The European countries whose policy is to increasingly rely on nuclear power see dependence on imported natural uranium as the one obstacle to nuclear self-sufficiency. While some assurance of security of supply can be obtained by a wide geographical spread of supply contracts, and by participating in exploration and extraction projects in potential supplier countries, the ultimate concern is over the longer term possibility that demand will eventually outrun supply. There is then in Europe a strong interest in ensuring the development of a stable uranium market in the short term, while the longer term aim is to secure some independence from imports through the separation and reuse of plutonium, notably in the fast reactor.

This concern over the availability and reliability of uranium supplies was clearly stated by Sir Hermann Bondi, chief scientist of the U.K. Department of Energy. Of this he said: 35/

Known resources in relation to forecast demand are small; speculative resources in relation to many demand scenarios are finely balanced. But even if geological availability were assured, physical availability remains unpredictable. Uranium is the most political of all commodities. There are already political and environmental constraints on uranium mining. We cannot be sure that resources discovered will become physically available. The message, once again, is one of uncertainty.

To remedy this situation, he argued that the forecasting of future requirements should be improved; that there should be international collaboration in the exploration and proving of uranium reserves, including joint venture investment by consumer countries; and that there should be work on: 36/

what my U.S. colleagues call 'resource extenders,' the greatest of which is the fast reactor. My delegation believes that the industrialized countries have a duty--to themselves and to developing countries--to ensure that, as uranium becomes scarcer and hence more expensive, fast reactors will be available to take the pressure off uranium supplies.

35/ Statement of the British delegate at the final INFCE Plenary Conference.

36/ Ibid.

Again in an article in *Nature*, just after INFCE, Sir Herman repeated this message: 37/

. . . [Although] the scope for new discoveries of uranium is good . . . the extent to which this will happen is uncertain . . . the more pessimistic a country, and the more dependent it is on uranium imports, the more likely it is to want to move to the early introduction of reactors that conserve uranium, such as advanced thermal reactors and fast reactors . . . fast reactors offer the prospect of nuclear development eventually almost free from uranium supply constraints.

Support for plutonium recycle.

The widespread support in Europe for continuing development of the fast reactor was endorsed at a recent meeting of the Foreign Secretaries of the European Economic Community countries which approved the techniques of reprocessing and breeding, thus acknowledging their role in decreasing the energy dependence of their countries. The need to recycle plutonium has long been a plank of the EEC nuclear policy, and it was to be expected that the Commission's view was that "the results of INFCE have by and large confirmed that the Community position is justified in . . . keeping open the option of recycling plutonium in thermal and fast reactors; this in turn implies the reprocessing of irradiated fuels." 38/ The same point was repeated in a later EEC paper which said: "The conclusion of the Conference (INFCE) confirmed the technical soundness of the Community's position with regard to the reprocessing of nuclear fuels and the maintenance and pursuit of the fast breeder option." 39/

Many European countries in INFCE specifically referred to plutonium in connection with fast reactor development. For example, the Italian delegate said: 40/

The role of plutonium in thermal reactors and even more in fast breeders in meeting our growing energy needs was singled out. The importance of being able to use reprocessing technologies, while avoiding negative consequences for nuclear proliferation, is obvious for all countries which, like Italy, have to take the limited amount of their national energy resources into account in developing their nuclear energy strategy and in the effort to reduce oil dependence and to increase diversification of supplies.

37/ Bondi, op. cit., p. 7.

38/ Report from the Commission to the Council on the International Nuclear Fuel Cycle Evaluation. EEC paper COM (80)-316, June 11, 1980.

39/ Energy policy in the European Community: perspectives and achievements. EEC paper COM (80)-397, July 10, 1980.

40/ Statement of the Italian delegate at the final INFCE plenary conference.

A number of European countries, notably Belgium, West Germany, Italy and Switzerland and possibly Sweden, also looked to recycling of plutonium in thermal reactors. ^{41/} A typical argument for this was put by the Swiss: ^{42/}

INFCE showed that compared with other fuel cycles, recycling plutonium in light water reactors did not raise any additional problems for non-proliferation, radiation protection or the environment . . . the recycling of plutonium in these reactors in reducing the requirement for natural uranium by about 30% improves the security of supply for those small industrial countries, as well as for the majority of the developing countries that do not have a closed fuel cycle.

The reaction of Belgium and Switzerland as an example.--The reactions of Belgium and Switzerland provide one of the more pointed examples of the attitudes of many of the smaller industrial countries. Both Belgium and Switzerland are countries without any appreciable indigenous energy resources. Both already are heavily dependent on nuclear power; in Belgium nuclear electricity is now 23 percent of the total generation and by 1988 it is expected to rise to 53 percent; and it is approaching 20 percent in Switzerland. Both countries are signatories of NPT, and it is difficult to think of two countries less likely to develop a nuclear weapon--even though both have the scientific, industrial and technical capability to do so. Both are members of the informal "London Club," as nuclear equipment suppliers (reactor components, fuel fabrication, reprocessing and plutonium fabrication in Belgium; reactor components and heavy water process in Switzerland) and would wish to develop their capabilities in the international market. Yet both are completely dependent on uranium imports, and in the case of Switzerland on access to enrichment services (Belgium is a partner in Eurodif). Neither wishes to have their essential supplies disrupted, or made subject to uncertainties, or to the imposition of unacceptable conditions. Switzerland, which has a reprocessing contract with COGEMA, has already encountered difficulties on this last point in obtaining uranium from Canada and United States. ^{43/}

The sensitivity of these two countries to these issues can then be seen in the statements by their delegates to the INFCE Final Conference. Belgium emphasized the need to increase the security of nuclear fuel supplies; that contracts between consumers and producers should be respected even though there may be appreciable changes in technology or attitudes; that engagements entered into under regional agreements (such as the Euratom Treaty) should be maintained; that there should be no discrimination in the use of nuclear fuels for peaceful purposes and in this, that the determination of what is "economically justified" should be left entirely to the country concerned. "A country should not be prevented from gaining a greater degree of energy self-sufficiency on

^{41/} INFCE, Report of Working Group 4, op. cit., p. 288.

^{42/} Statement of the Swiss delegate at the final INFCE plenary conference.

^{43/} Nucleonics week, October 13, 1977, p. 11.

incomplete economic arguments". With its experience in plutonium fuel fabrication, Belgium is one of the countries interested in recycling plutonium in thermal reactors. INFCE working group 4 estimated that the Belgium thermal recycle to the year 2000 would use a total of 2.54 metric tons of plutonium to give savings of 406 tons of natural uranium and 406,000 Separative Work Units of enrichment. ^{44/} The Swiss programme is only slightly smaller, with an estimated 2 metric tons of plutonium cumulative to the year 2000 being recycled in thermal reactors. Switzerland, in addition, argued that the renunciation of nuclear weapons should be made more attractive. Those countries adhering to the NPT should be offered compensatory advantages in other areas, and this was the intention of Articles IV and VI of the Treaty--but, said the Swiss, there is now a trend to add discriminatory measures in the peaceful use of nuclear power in addition to those which already exist between weapon and non-weapon states. The Swiss say that the goals of nuclear power development and of non-proliferation are not opposed, that on the contrary they could reinforce each other. Countries with nuclear programmes have a strong interest in ensuring the continuity of their supplies in materials, services, equipment and technology. They also have an interest in developing access to these by international agreements and in avoiding compromising their interests by any nuclear explosive activities.

The Swiss, like most other European countries, also underlined their view that unilateral revocation of contractual conditions would not maintain stability between consumer and producer countries. Any modification of non-proliferation conditions should be the result of mutual agreement between all the parties concerned, and should be founded on internationally acceptable rules which provide coherent and uniform control to the exchange of materials, services, equipment for the different stages of the fuel cycle. The Swiss also supported the Franco-British proposal that such rules should be worked out by a new expert group working under the guidance of the IAEA.

Many of these points were raised again by Switzerland at the Geneva NPT Review Conference of August 1980. There Switzerland proposed that national legislation should not in any way reduce or affect the obligations, rights, and mutual responsibilities contained in the Treaty. It asked for "pluri-annual" licenses to permit stable long term planning; and called on exporting states not to prevent or hinder in any way the export of fuel, equipment, technology or nuclear materials to parties which were fulfilling their international obligations.

The Swiss delegate to the review conference, C. Zangger, complained that American practices had delayed nuclear deliveries for months, and that Switzerland had also been affected by a Canadian embargo. The Swiss Government had never thought that restrictions would apply to reprocessing. New policies had also limited the use of fast-breeder reactors. The U.S. policies had changed with changes of government--but national regulations ought to correspond to international consensus despite changes in government. ^{45/}

^{44/} INFCE, Working Group 4, op. cit., Tables 13, 14, 15 and pp. 288-292.

^{45/} United Nations press release NPT/40, August 26, 1980.

A possible explanation of the background to these strongly expressed Swiss views may be found in a report in the Financial Times (23rd September 1980) that the United States was withholding its permission for Switzerland to ship spent nuclear fuel of American origin to France for reprocessing, or to sell Italy some plutonium. It suggested that the delay was an expression of U.S. displeasure with Switzerland over the supply of sophisticated industrial equipment for the Pakistan uranium enrichment plant. The Swiss denied this and said it was standard industrial equipment. Another Financial Times report (1st September) linked the intensification of the dispute between Switzerland and Canada with Canadian disapproval of the Swiss Government's decision to allow the Sulzer Company to build a heavy water plant in Argentina. The Canadians are said to have denied this. But in any event, a Swiss Parliamentary Commission postponed signing a draft agreement with Canada, under which supplies of uranium would have resumed, on the grounds that it would allow Canadian interference in Swiss internal affairs. The dispute centers on Canadian insistence on the right to monitor how its uranium and nuclear technology are used in the event they are re-exported from a client nation, such as Switzerland, including to third world countries which might misuse them to make nuclear weapons. The tougher attitude of the Swiss Parliamentary Commission was said by the Financial Times to be inspired by estimates of the Swiss energy authority that Switzerland can do without Canadian uranium for at least five more years.

A different slant is given in a Guardian report (9th September 1980) which suggested that the Canadians were trying to force a cancellation of the unbargained contract for 900 tons of uranium for which the Swiss had paid in advance because the value of the Swiss consignment had increased by 90 million dollars since the contract was signed. This report also observed that the Canadian right to prior consultation on Swiss plans to export technology to determine whether Canadian technology had been involved would give Canada a decisive advantage over the Swiss in any bid to supply third countries--and it noted that Canada had competed unsuccessfully against Sulzer to supply on the Argentine heavy water plant.

Reliable nuclear supplies for developing countries.

INFCE provided many developing countries with opportunity to press for stable and reliable nuclear supplies, and some nuclear suppliers were sympathetic.

The Germans touched upon this point, possibly with their agreement with Brazil in mind, saying at INFCE: 46/

The intensive participation of a number of developing countries in INFCE confirms the importance which they attach to nuclear energy as a means of securing their energy supplies and hence their economic growth in view of the aggravated world energy situation. The Government of the Federal Republic of Germany has always attached importance to co-operation with the Third World. It does so also in the peaceful use of nuclear energy including the further development of an effective non-proliferation policy which has the widest possible support. And it feels that this policy has been confirmed by the work done within the framework of INFCE.

46/ Statement of the West German delegate at the final INFCE plenary conference.

For their part, the Brazilian response to INFCE was described as one of relief and diplomatic excitement. Sen. Heirvasio de Carvalho, Director of Brazil's nuclear energy agency, the CNEN, was quoted in June 1980 as saying: 47/

There was a consensus at the meeting that its conclusions will have no moratorium effect on our nuclear programme and will not serve as a pretext for modifying existing treaties.

This leads to what is perhaps the most sensitive part of the non-proliferation issue: the attitudes taken by and towards the developing countries. INFCE itself recognized at the Washington organizing conference, in October 1977, that "special consideration should also be given to the specific needs of, and conditions in, developing countries". And in a phrase, echoed by the Turkish delegate to the Final Plenary Conference, and that appeared in the declaration of September 1979 from the Conference of Non-Aligned Countries in Havana: 48/

The use of nuclear power for economic and social development has been considered an inalienable right for all countries and a viable electricity supply option in a number of developing countries.

But, almost by definition, developing countries tend to be politically unstable. Changing from rural, peasant economies to industrial economies can induce strains in the social fabric which are sometimes too great to be sustained. It has been argued that societies have a certain threshold of tolerance for rate of change, which, if exceeded, leads in some measure to social disintegration. 49/ It is possible that this contributed to the revolution in Iran, where the Shah, conscious of the relatively short life of the oil reserves, had been pushing his country into industrialization at a rate too fast for a majority of the population to tolerate.

Examples of sensitivity in supply of equipment and technology to developing countries can be taken from France. Le Monde, on 29th February 1980, in an article on INFCE, "The Struggle Against Atomic Proliferation", noted that even though M. Olivier Stirn, Secretary of State for Foreign Affairs, had stated in Islamabad on 25th February, 1980 that the question of the delivery by France to Pakistan of a reprocessing plant was still open, it was evident that under present circumstances France would not supply this installation. On the other hand it seemed from INFCE that the use of low enriched fuels in research reactors was further off than might have been expected. 50/ It was reported that proposals

47/ Nature, June 3, 1980, p. 9.

48/ Conference of Heads of State or Governments of Non-aligned countries, Havana, September 3-7, 1979.

49/ Mental health aspects of the peaceful use of atomic energy. World Health Organization Technical report series 1958, 151.

50/ INFCE Summary volume, op. cit., p. 40.

by France to supply low-enriched "Caramel" fuel for the 70 MW Osiris experimental reactor which it is building for Iraq have been rejected by the Iraqis. The French CEA has since declared that this fuel is still under development and not yet commercial. 51/

Yet any post-INFCE suggestion that there should be discrimination between countries according to their state of development, or between weapons states and non-weapons states would arouse widespread resentment from both the smaller industrial countries and from the developing world. The distinction between those countries which can be considered as suppliers of nuclear materials and technology and the customer countries is not clear cut. Even within the London Club, only four countries, United States, the Soviet Union, France and Canada, can be regarded as being nuclearly self-sufficient. The remaining members are dependent to a greater or lesser extent on imports of materials and services.

Views of the Uranium Institute: a comprehensive indicator.

For the nuclear industry the main concern is over the supply of uranium and the extreme sensitivity of nuclear trade to sudden changes in government policies. Representations on this point were made to INFCE by the Uranium Institute, a body which brings together both the producers and consumers from eleven different countries. One paper, "Government Influence on International Trade in Uranium," set out eleven guiding principles for government controls over the export of uranium intended to make trade in uranium more stable and more predictable. A second paper, "The Nuclear Fuel Bank Issue," suggested that it would be better to make a wider use of existing instruments, with some financial incentives and government encouragement rather than try to create a new, complex international institution.

Support for INFCE's conclusions.--From the viewpoint of the uranium industry, INFCE was regarded as a major contribution to clarifying the issues of non-proliferation. Although most of its conclusions were already familiar to professionals in the nuclear field, they had now been discussed and recognized at a wider political level. The Uranium Institute also noted that there was no conflict of objectives between industry and government in this area. 52/

On the contrary, there are substantial advantages in terms of costs and security of supplies, in addition to the obvious political benefits, to be won from having an internationally accepted, uniform and stable set of non-proliferation rules.

51/ Financial Times, April 3, 1980.

52/ The Uranium Institute. The International Fuel Cycle Evaluation Report: Initial commentary. March 1980, p. 5.

Discussing uranium demand, supply and availability, the Institute was cautious. On one hand, it saw no reason to believe that future discoveries would be insufficient to provide adequate supply capacities over a longer term. On the other hand, an assessment of reserves is only part of the story. According to the institute: 53/

Uranium is of no use until it has been extracted and made available on an assured basis and on acceptable terms . . . Given the difficulties encountered over the past decade, even in countries with stable political constitutions, it is clearly an oversimplification to assume that the actual supply of uranium will, everywhere and always, reach the level justified by prospective demand and made physically possible by the level of reserves.

Predictability of nuclear supply.--On trade in nuclear fuel and security of supply, it was important to keep in mind that long-term uranium supply contracts typically are for periods of ten years, which leaves the market vulnerable to unforeseen political changes. The institute urged greater predictability and certainty in nuclear commerce, saying: 54/

. . . The industry thus particularly supports the views of INFCE Working Group 3, which argues strongly for greater predictability in nuclear commerce based on long-term contracts; and for the reduction of uncertainty in the application of controls over exports (and, where appropriate, imports) in nuclear trade, in as uniform and foreseeable a manner as possible. The industry believes that governments can assist this process by refraining from unilateral action; more positively, they can create the right political climate by taking practical steps to increase mutual reliance and trust between suppliers and consumers.

Opposition to case-by-case administration.--Also in the vein of increasing predictability and certainty in nuclear supply, the Institute opposed the case-by-case approach by nuclear suppliers, saying: 55/

. . . case-by-case consent is not the most effective approach to promoting non-proliferation objectives, however appealing such an approach may appear on the surface. In fact, both unilateral trade interruptions and case-by-case consent make dependence on international resources less attractive, thus fostering construction of local facilities which, by definition, create additional proliferation fears. This applies to consent on reprocessing as well as on retransfers. The industry fully recognizes that non-proliferation conditions imposed by governments cannot remain

53/ Ibid., p. 6.

54/ Ibid., p. 7.

55/ Ibid.

fixed forever. But changes must not be frequent, and should apply only to future contracts--not to future deliveries on existing contracts. This has been explicitly or implicitly recognized by INFCE and the industry wishes to stress the extreme importance of the point.

Principles for government action.--The Uranium Institute recognized INFCE's conclusion that non-proliferation is a political matter primarily for government action. Because industry is necessarily involved in the practical consequences of implementing the regulations, it should be consulted at the earliest stage if ineffectuality and confusion are to be avoided. Eleven principles to guide government action were offered as being broadly compatible with the views expressed in INFCE. But it was emphasized that INFCE considered the use of natural or low enriched uranium not to require any additional non-proliferation measures other than the IAEA safeguards. For other fuel cycle activities, the institute urged the removal of artificial or unnecessary obstacles to the development of an essential source of energy. Of this the institute said: 56/

More positively, the creation of active, real markets for nuclear services, such as enrichment and reprocessing, could be instrumental in promoting a viable non-proliferation regime. Indeed, contrary to a good deal of current thinking, non-discriminatory access to internationally accepted enrichment and reprocessing facilities, with proper guarantees against unilateral changes in supply conditions, provides the best means for avoiding the excessive diffusion of such facilities at the national level. In contrast, all unilateral vetoes are powerful catalysts for developing local expertise and facilities in consuming areas--and it is the dispersion of sensitive nuclear materials, facilities and technologies which leads to much current anxiety about proliferation.

* * *

. . . But national autarky is very costly, except in cases where requirements are very large. Thus the willingness to pay a large premium in order to rely on domestic supplies can be considerably reduced if international sources of supply are organized in ways which inspire maximum trust.

Reprocessing.--The arguments for predictability and certainty apply in particular to reprocessing, which many countries still viewed after INFCE as necessary not only for energy recovery from uranium but also for safe disposal of spent nuclear fuel. The French, for example, have expressed alarm at the accumulation of substantial amounts of unprocessed spent fuel in the future, seeing a proliferation risk in the contained plutonium. For most countries the problem is still not pressing and the world's reprocessing industry remains at an early stage with projected capacity much below anticipated requirements. From the viewpoint of the Uranium Institute: 57/

The development of domestic reprocessing capacity in countries having large nuclear programmes and having accepted effective

56/ Ibid., p. 9.

57/ Ibid., p. 10

international safeguards such as those of the IAEA, could do more to prevent the scattering of fissile material than any prohibition on developing such services. Indeed, such development could provide other countries having reprocessing requirements with supplies from a diversity of sources, and thus greater stability and security.

Problems of developing countries and nuclear power.--The Uranium Institute also considered the problems of the developing countries that turn to nuclear power once a certain level of power consumption is reached. The skills demanded are not proving insuperable and the process is likely to continue, encouraged by the economic advantage of nuclear power. But their search for greater economic security is hampered by the present unreliability of supplies of nuclear materials, equipment, and technology: 58/

If political disappointment and economic hardship are to be avoided, it is vital that those countries should be able to count on assured access to the nuclear goods and services which they need. If that assurance is not available, they will have to face either the failure, or at best postponement, of their development plans; or the need to build up their own nuclear fuel cycle capabilities, including enrichment and reprocessing, at heavy cost and at the risk of causing proliferation anxieties, whether justified or not.

Safeguards.--On safeguards, the Uranium Institute again noted that for natural and low enriched uranium, which cannot be used directly for nuclear explosives, present safeguards are recognized as satisfactory. INFCE however, drew attention to the need for further improvements in safeguarding materials that could be directly used for nuclear weapons, a view which the institute supported, saying: 59/

The industry welcomes such improvements, along with continuous efforts to keep international safeguards compatible with the safe and efficient operation of nuclear facilities. One contribution which the industry can make is to take into account non-proliferation requirements, including effective IAEA verification procedures, when designing plants.

58/ Ibid.

59/ Ibid., p. 11.

CHAPTER 3: OPTIONS FOR POST INFCE NON-PROLIFERATION POLICY

Post export controls for nuclear exports.

INFCE can now be seen as a turning point. As has been earlier observed, the conclusion of INFCE can, and will, be interpreted as legitimizing all peaceful nuclear aspirations. For those countries who participated in the Final Plenary Conference of February 1980, to the extent that they heard their opinions confirmed and reinforced by others, it will strengthen their resolve to see expressions of view turned into an effective course of action. A continuation of a policy of denial by nuclear supplier states, with case-by-case exemptions would not seem possible in the post-INFCE climate. The arguments of INFCE Working Group 3 that assurance of supply and assurance of non-proliferation are complementary was widely endorsed. It is an interaction that works both ways, as the Finnish delegate pointed out at INFCE when he said: 60/

The better the non-proliferation system, the more assured the supply.
The better assured the supply, the more willing are the recipients
to accept non-proliferation conditions.

It was an argument also accepted by U.S. representatives Gerard Smith and George Rathjens who later wrote: 61/

To the extent that one attaches importance to preventing the spread
of reprocessing and enrichment as a means of reducing proliferation
risks, assurances of supply of both enrichment service and uranium
could be of great importance.

These assurances are needed, not only by the developing countries but also by many of the industrial nuclear supplier countries, including members of the London Club, who are still largely dependent on imported uranium and enrichment.

This leads on to the vexatious issue of "prior consent" insisted upon by Australia, Canada and the United States. "Prior consent" refers to the permission required by a supplier nation for the reprocessing of spent nuclear fuel, the enrichment of it beyond 20 percent, the retransfer of uranium by the consumer to another nation, or certain other actions by a user state affecting its imported nuclear materials. In a post-INFCE paper to the Fifth Annual Symposium of the Uranium Institute, A. J. Grey, on behalf of the Institute's

60/ Statement of the Finnish delegate at the final INFCE plenary conference.

61/ Trialogue, Nov. 22, 1980, pp. 18-21.

Committee on International Trade in Uranium, noted that consuming nations are becoming increasingly resistant to the inclusion of prior consent clauses, which they see as a veto over their fuel cycle decisions. This is the major stumbling block to the conclusion of bilateral safeguards agreements which are required to underpin commercial contracts now under negotiation for the supply of uranium and nuclear fuel services. But, according to Grey: 62/

A solution to this problem could possibly be found in a clause providing for the consent to reprocessing being given on a general program by program basis. It appears that at least one exporting government is favorably considering this approach.

The views of both producers and consumers on the Uranium Institute's committee on this issue of prior consent were then put forward as: 63/

- Reasonable alternatives to the case-by-case prior-consent procedure exist. The ideal is clearly the formulation of one universally agreed set of non-proliferation and safeguard rules, applicable to all international trade. Until that perhaps distant ideal can be realized, interim measures--involving generic prior-consent arrangements, a more flexible use of the existing IAEA Statute, and the acceptance of greater trade freedom between nations that have accepted identical export conditions--could go far towards re-establishing the credibility of security of supply commitments. This could be done in ways consistent with the objectives of both supplier and consumer nations, and with the needs of industry.

The IAEA's Committee on Assurances of Supply.

To the extent that their security of nuclear supply is seen as threatened, countries will wish to establish their own fuel cycle industry either on a national or regional basis, possibly being led to construct sensitive facilities even in those cases where a small nuclear power programme would not justify such decisions on economic grounds. INFCE has provided a pause for reflection and for a return to the procedures of multilateral consultation to avoid such situations. An important post INFCE step was the decision by the IAEA Board of Governors to establish a Committee on Assurances of Supply. Open to all Member States, its charter is to:

Consider and advise the Board of Governors on ways and means in which supplies of nuclear material, equipment and technology and fuel cycle services can be assured on a more predictable and long-term basis in accordance with mutually acceptable considerations of non-proliferation and the Agency's role and responsibility in relation thereto.

62/ Anthony J. Grey. Taking stock after INFCE. In Uranium and nuclear energy: 1980. Proceedings of the Fifth International Symposium held by the Uranium Institute. London, 2-4 September, 1980. Guildford, England: Westbury House, 1980, p. 308.

63/ Prior-consent and security in international nuclear trade. Uranium Institute, October 1980, p. 15.

This Committee, which started work in the autumn of 1980, is seen as an important instrument for rebuilding on the basis of Article IV of the NPT confidence in the long-term security of nuclear supplies. A consensus leading to long-term supply assurances would in turn inevitably strengthen and improve the international acceptance of safeguards.

Institutional arrangements as proliferation barriers.

Although a general acceptance of rules for commercial uranium supply contracts would probably meet the needs of the nuclear industry and satisfy the exporting countries that adequate safeguards were being applied, something further is required to control the spread of "sensitive" nuclear facilities, and, in particular, to meet the fears that such facilities in unstable countries may be withdrawn from the international safeguards system. One approach could come from a further development of the "institutional arrangements" considered at INFCE. These include a range of undertakings either by governments or private entities to facilitate the efficient and secure functioning of the nuclear fuel cycle, including international and multinational institutions. An important first step was the special welcome given by all countries at the Final Plenary Conference to the proposals now being worked on by a group of experts under IAEA auspices. As INFCE noted, such a scheme: 64/

Could have important non-proliferation and assurance of supply advantages. Whether or not most countries decide to reprocess their spent fuel, the scheme would be relevant, since separated plutonium already exists in the world and some countries have definite plans to continue to introduce reprocessing.

International plutonium storage.--An internationally accepted system for the storage and use of plutonium with specific provision for the release of the material could, in the words of the UK delegate: 65/

Replace much of the present complex of supplier controls . . . it would both reduce the risk of misuse of plutonium and provide greater assurance in the eventual supply of plutonium to those whose civil programmes require it.

Conditions for an IPS scheme could be that:

- The existence and quantity of all plutonium separated within the jurisdiction of the state should be notified for registration immediately after separation;

64/ INFCE summary volume, op. cit., p. 46.

65/ Statement of the British delegate at the final INFCE plenary conference.

- All plutonium in excess of that required for specified uses should be deposited in an international plutonium store. The specified use--which should be peaceful and subject to IAEA safeguards--could include research projects or as a reactor fuel;
- Plutonium should not be transferred to another state, except as specified in the authorization for its release;
- The Agency be notified if plutonium has not been taken into the authorized use for which it was released within a specified period; and to return such plutonium to an IPS if so required;
- An existing or planned storage facility be proposed for designation as an International Plutonium Store;
- The Agency be provided with all information as is necessary under the scheme on their holdings of plutonium and on their nuclear facilities using plutonium; and
- States would have the right to prompt return of their deposited plutonium after application for the uses specified which are peaceful and under IAEA safeguards.

If an IPS can be made to work successfully--and the chances seem good given the widespread support for the proposals and the willing acceptance of both France and United Kingdom, the two countries now producing plutonium from operating reprocessing plants--it could provide the experience to develop further schemes for international management of spent fuel and regional fuel cycle centers.

These ideas revived support not only from the consumer, but also from the supplier countries. Australia, which is exclusively a supplier, considered that the two international schemes for plutonium storage and spent fuel management have the promise of doing much towards meeting the goals that all have in mind. Mr. R. W. Fox, the Australian Ambassador-at-Large for Nuclear Non-Proliferation and Safeguards, in a personal capacity has recommended a programme of non-proliferation measures that would in addition include the joint participation by several countries in sensitive processes. Of this he said: 66/

Such a program can be supported as follows: (a) it seems reasonably practical; (b) it would also be direct, offer a high degree of visibility in operation and not be dependent only upon promises and declarations, thus enhancing public acceptance, and (c) three of

66/ R. W. Fox. Export of nuclear materials. In Internationalization to prevent the spread of nuclear weapons. Stockholm International Peace Research Institute. London: Taylor & Francis Ltd., 1980, pp. 194, 105.

the schemes, those dealing with plutonium and spent fuel control, and that dealing with physical protection, are, at present, being examined under the auspices of the International Atomic Energy Agency.

and

. . . If sufficiently well thought out, the schemes, taken together, should provide us with virtually all the confidence and protection we want. They can allow progressive development to meet any doubts or problems found to arise in practice. As to what we might finally arrive at, we should allow experience to be the guide and success the advocate.

International uranium enrichment.--An interesting example could be made if the enrichment project being considered for Australia were to be built as a tripartite company with partners from the countries supplying the technology, customers, possibly some of the capital and Australian uranium it would be well high impossible for material from such an enrichment plant to be diverted to military use by the host country without the other partners being aware of it. Such a scheme could be used as a model for other enrichment or reprocessing plants. The tripartite URENCO (Germany, Netherlands, United Kingdom) enrichment project also goes some way towards this end.

In this context it is interesting to note that the Netherlands delegate supported this approach at INFCE saying: 67/

Such arrangements especially with regard to the sensitive stages of the fuel cycle, can vary within a wide range of possibilities from merely financial participation by customers in the facility concerned to a complete involvement in all aspects of the management.

Plutonium buyback as a non-proliferation measure.

Because of government preoccupation with non-proliferation policies it is often overlooked that most nuclear utilities tend to think of the spent fuel as a nuisance they would be only too happy to be rid of, rather than to hoard it for nefarious purposes: The Finnish delegate to INFCE illustrated this view in his statement that: 68/

One of the main concerns of countries with small nuclear programmes is the back-end of the fuel cycle. Services are either not available or their availability is subject to far-reaching conditions. Furthermore, options to return the vitrified-high level waste from reprocessing to countries where [nuclear] electricity was generated are

67/ Statement of Dutch delegate at final INFCE plenary conference.

68/ Statement of the Finnish delegate at the final INFCE plenary conference.

advocated. The reports [of INFCE] provide economic, safety and non-proliferation reasons for not returning the waste. Finland attaches utmost importance to this lack of commercial technology and services in the back-end and expects that countries with much larger nuclear industries would provide waste management and disposal facilities.

The Finnish delegate also drew attention to the point that the use of plutonium would start only in a limited number of reactors, whether LWR's or FBR's, and that wider deployment would take place gradually over a longer time. Seen in this light, it is difficult to know whether spent fuel is an asset or a liability. For countries considering stockpiling and possible final disposal into a repository, costs will be incurred and the material would be a liability. Other countries that have invested in plutonium facilities and who expect to put it to productive use will consider the spent fuel an asset. This has led INFCE's Working Group 3 to consider the ideas of a "plutonium credit", whereby: 69/

. . . title to plutonium contained in spent fuel or recovered in reprocessing operations could pass conditionally or indefeasibly from a given company or country to another country or to a multinational or an international venture which would, in some way, compensate the customer for the energy content of its spent fuel.

This idea was taken further by Dr. Walter Marshall of the UKAEA, who argued post-INFCE that because of their high capital costs and the need for extensive investment in fuel cycle plant as well as the high cost of development, the timing of introduction of fast reactors will be different in different countries. But there could then be a limitation upon the number of fast reactors they could install because of the lack of availability of plutonium. The breeding capabilities of fast reactors would not, initially, provide sufficient fissile material for new stations and the breeder countries would have to depend upon spent fuel from thermal reactors. These countries then have an incentive to trade with other countries producing, but not intending to use, spent thermal reactor fuel. This assumes, of course, that the cost of transporting and reprocessing spent fuel and or subsequent plutonium fuel fabrication would not make the plutonium too expensive to use.

As proposed by Dr. Marshall: 70/

This mutual economic benefit, which is a natural consequence of international trade in spent thermal fuel, also assists an international non-proliferation regime because it concentrates, on a voluntary basis, fast reactors and plutonium in a limited number of countries . . . different countries could well elect to make different choices as to the types of nuclear plant they

69/ INFCE, Report of Working Group 3, op. cit., p. 83.

70/ Walter Marshall. Plutonium breeds international unity. New scientist, vol. 85, March 6, 1980, p. 732.

would install. Some countries would be operating fast reactors, and fast and thermal reactor fuel cycle plants. A second group of countries would be operating thermal reactors on a 'reprocessing cycle' (buying reprocessing services from the first group). And we could have a third set of countries not seeking themselves to use the fissile materials in spent fuels, but instead of selling the fuel to the fast reactor countries, against suitable payment. Such a scheme could prove so stable economically, that countries would move only gradually from one regime to another as their nuclear systems slowly grew. They would at no time feel themselves economically impelled to move prematurely into building either reprocessing facilities or fast reactors.

Proliferation as a continuing political problem.

As was noted by INFCE, and by Dr. Marshall and other commentators, the routes to a nuclear weapons capability are many and various. Any country at a sufficiently advanced industrial stage can have nuclear weapons if it decides to do so, and this will not depend on the kind of civil nuclear facilities it has. The problem of proliferation is a political one. It should however be possible by appropriate measures, such as discussed in INFCE, to establish a clear separation between civil and military nuclear programmes. International facilities with joint ownership and control by several countries could do much to ensure that there was no diversion to military ends.

The assurances of supply in return for assurances of non-proliferation would also enhance the necessary expansion of nuclear power. A refusal to participate in such schemes would also identify those countries that for political reasons have chosen to keep open the option of making nuclear weapons. Any real solution of this problem must then be rooted in appropriate political and diplomatic action, based on international consensus. In the words of David Fischer of the IAEA, "the risk of proliferation begins where safeguards stop."

Pakistan as an example.--Pakistan like India is outside the NPT. It has one nuclear power station, Kanupp, a 137 MWe natural uranium heavy water reactor supplied by Canada. This has been shut down from mid-1979 because of Canada's refusal to supply uranium for fuel in the light of attempts by Pakistan to acquire a reprocessing plant from France, and with the evidence that Pakistan is building an enrichment facility. But the Pakistan government has announced that Kanupp will restart using natural uranium fuel manufactured in Pakistan from their own uranium. ^{71/} This demonstrates that a policy of denial has only a limited effect upon a determined country; the delays incurred and the increased costs are not sufficient penalties to induce a country to join NPT so as to avoid them.

^{71/} Nature, vol. 287. Sept. 18, 1980, p. 181.

The aim must be to persuade Pakistan as well as other countries outside NPT to accept IAEA safeguards on all their nuclear activities by some stronger political means. Yet this should be coupled with meeting their legitimate nuclear needs promptly and reliably so that they have no incentive to establish independent nuclear facilities which may prove to be an economic burden. A major step is in easing the tension between neighbouring states that often lies at the root of any attempt or desire to acquire nuclear weapons. The problems in Afghanistan, Iran and Iraq show that this is no easy task. At the same time there should be some way of discriminating in favour of those countries within NPT which have accepted safeguards. Perhaps this should extend beyond the nuclear field.

INFCE has helped to identify the separation between civil and military use of nuclear power. It has been said that if every nuclear power plant throughout the world were to be shut down the problem of weapons proliferation would remain. ^{72/} Here then is the political problem for the post INFCE world--how to deal with nations that may seek to acquire nuclear weapons directly and independently from any civil use of nuclear energy.

^{72/} Statement of David A. V. Fischer at the final INFCE plenary conference.

PART III: EUROPEAN REACTION TO INFCE, A DIFFERENT VIEWPOINT

Walter Patterson
January 1981

CHAPTER I: OVERVIEW

In May 1977, U.S. President Jimmy Carter met with the heads of government of six other leading Western industrial nations in London, England, at what became known as the Downing Street summit. One of the main concerns at this meeting was the possible relationship between civil nuclear power and the proliferation of nuclear weapons. This concern, as pinpointed by Presidents Ford and Carter in their statements of 28 October 1976 and 7 April 1977 respectively, focused on plans for the commercial use of plutonium as fuel for nuclear power plants. Such plans were already well-advanced in several European countries, including the United Kingdom, France and the Federal Republic of Germany. The clash of views about this issue led the heads of government at the summit to agree to establish an International Nuclear Fuel Cycle Evaluation (INFCE).

INFCE has been called by some the most detailed and comprehensive study of nuclear power ever undertaken. With this in mind, the Congressional Research Service of the Library of Congress initially requested preparation of the present report, as mentioned in the preface. The requested analysis, however, would have to be based on certain premises regarding INFCE which appeared to be unfounded. My report will therefore endeavor to discuss and analyze the state of affairs post-INFCE, with particular regard to the United Kingdom and Europe, and to establish why some of the premises implicit above do not appear to hold.

The purpose of this part of my report is to present an overview of the principal effects on governments policies, nuclear industries, concerned organizations and the public to date and to be expected of the conclusions and observations of INFCE. Such an overview can be summed up with disconcerting concision. In Europe the effects of INFCE on the above-named groups have been essentially negligible, if not non-existent. Indeed, in personal conversation with the author of this report, one highly placed spokesperson for the United Kingdom Atomic Energy Authority characterized INFCE as a "non-event". To the extent that INFCE had any perceptible effect at all, it served merely to reinforce the established attitudes of all the above-named groups, whatever their attitudes toward nuclear power. Succeeding sections of this report will amplify this overview, qualify it as necessary and, in particular, attempt to identify and comment on the reasons for this perhaps unexpected outcome of a major international exercise.

CHAPTER 2: REASONS FOR INFCE'S UNEXPECTED LACK OF EFFECT

Proliferation as a political problem.

Undoubtedly the single most important implication for future European and U.S. policies regarding the prevention of the proliferation of nuclear weapons from commercial use of nuclear energy and of plutonium arises from the INFCE finding that all various nuclear cycles are more or less equivalent as regards proliferation, and that there is no technical means available or conceivable to eliminate the possibility of proliferation through civil nuclear energy. Proliferation, according to INFCE, is a political not a technical issue, and is therefore the province of the politicians, not of the nuclear technical community. Reactions to this overall INFCE finding will be outlined and discussed below.

Little evidence of INFCE's effect.

Government policies regarding the development of civil nuclear power, the commercial use of plutonium and the export of nuclear technology and information gave rise to the concerns which prompted INFCE. There is little visible evidence in Europe, however, that any consequence of INFCE has materially altered any of the specific government policies whose consequences might have been considered significant from the INFCE point of view. Since the publication of the final INFCE report, there has been little if any significant change in apparent government policies regarding civil nuclear programmes. Construction of those reactors and fuel cycle facilities planned before the establishment of INFCE since its conclusion have continued unaffected. While alterations in civil nuclear programmes, particularly delays, have occurred, the reasons have been unconnected with INFCE either directly or indirectly. Those few export agreements with European participants which have continued or commenced since INFCE show no sign of being influenced by its findings, except insofar as INFCE gives an equivalent green light to all forms of nuclear technology within the existing international framework of safeguards.

Attitudes of European nuclear industries.

Nuclear industries in Europe continue to advocate policies and espouse programmes which are direct extensions of those advocated and espoused before INFCE began. Nuclear industry spokespeople make occasional passing reference to INFCE as offering no hindrance to particular plans or proposals; otherwise there is little sign that INFCE has even slightly altered the outlook of nuclear industry planners and policy makers in Europe.

Reactions of non-nuclear bodies.

Among concerned organizations outside of the governments and the European nuclear industry itself are a variety of environmental organizations and other groups opposed either in general or in particular to civil nuclear developments; peace organizations, including those concentrating on research and those concentrating on campaigning; and perhaps other organizations with an interest in international development policies, especially as these concern the so-called Third World. A random but extensive survey of the periodicals and other publications produced by these organizations reveals scarcely a jot of evidence indicating, even an awareness that INFCE had reported, much less any reaction to its conclusions and observations. No U.K. environmental organization, peace organization or other group or individual critical of civil nuclear policy saw fit to publish formal comment on the outcome of INFCE.

Public reaction.

A review of the popular press also shows no evidence to suggest that the European public, however defined, either knew or cared that INFCE was taking place or about its observations and conclusions. The effect of INFCE on the European public can without exaggeration be given as nil.

Effect on the atmosphere for nuclear diplomacy.

One major positive effect of INFCE nevertheless can be identified, which, paradoxically, is unrelated to INFCE's observations and conclusions. The diplomatic atmosphere surrounding international nuclear affairs by 1977 had become tense and suspicious, and was riddled with mutual distrust and declining confidence. INFCE provided an interlude during which those involved in international nuclear discourse were able once again to reestablish lines of reliable communication. The prominence assigned outside the United States to INFCE Working Group 3 on assurances of supplies is one explicit indication of the role assigned to INFCE by its European participants. INFCE may have done little if anything to resolve outstanding points of controversy; but it lowered the temperature of the discussion and cleared the atmosphere. The problems of 1977 still remain; indeed, some have since become more acute and others have developed new dimensions. Nevertheless, many Europeans consider INFCE to have been worthwhile simply for its effect on the psychology of international nuclear diplomacy.

CHAPTER 3: VARIETIES OF NATIONAL REACTIONS

National reactions to INFCE while sharing some common elements also differed in some respects as shown in the following discussion of reactions in the United Kingdom, West Germany, France, the Netherlands, Euratom, and the IAEA.

In the United Kingdom.--In the United Kingdom, the government's nuclear policy was spelt out by the Secretary of State for Energy, Mr. David Howell MP, in a statement on December 18, 1979. This statement endorsed the concept of a continuing programme of orders for new nuclear power stations for the coming decade. Within the United Kingdom, work continues on the enlargement of the gas centrifuge enrichment plant at Capenhurst and the planned construction of a large reprocessing plant for uranium oxide fuel at Windscale. In early 1980 the regulatory authorities authorized the shipment of plutonium nitrate solution from the small fast reactor fuel reprocessing line at Dounreay, by ship and road to Windscale. Discussions continue about international cooperation in the development of the fast breeder reactor. None of these policies has been visibly influenced by the outcome of INFCE.

As for attention in Parliament, on February 27, 1980, the Parliamentary Under-Secretary of State for Energy, Mr. Norman Lamont MP, made a statement in the House of Commons. He said: 73/

"The final plenary conference of INFCE was held in Vienna this week; and the reports of the Evaluation have been adopted by the sixty or so governments who took part, which included the United Kingdom. Following their adoption, the reports have been published by the International Atomic Energy Agency. Copies of the reports have been deposited in the Libraries of the House. The Government will now consider the findings of this important International Evaluation and any implications it might have for U.K. policies."

So far as has been ascertained, this was the first and last public reference to INFCE by a U.K. Government minister. The Department of Energy press notice quoting this statement was accompanied by a brief summary of the INFCE report prepared by the department. This summary gave no indication of the British government's reaction to INFCE observations and conclusions, nor was it widely circulated to media in Britain. Indeed, its circulation was largely limited to correspondents at the final plenary conference in Vienna.

Some further indications of the limited impact of INFCE upon the viewpoint of the British government are to be found in address of Mr. Ivor T. Manley, Under-Secretary in the Atomic Energy of the U.K. Department of Energy, to a symposium of the European Safeguards Research Institute's fifth annual symposium in London

73/ Official Reports, Hansard, daily issue. Vol. 979, 1980, No. 126. February 27, 1980: c. 584.

in September 1980. Mr. Manley spoke favorably of INFCE as an American initiative, saying:

They were right to call for INFCE, to recognize that their policies could not be imposed on other countries, and to postpone, where necessary, the now obligatory renegotiation of their co-operation agreements until INFCE had been completed.

His summary showed INFCE as a prescription for restoring the health of international nuclear trade. Almost as an afterthought, he added that if assurances of supply are to be one side of the new bargain for reliable nuclear supplies, safeguards will be the other. His call for the diplomatic community to work for the widest acceptance of full scope safeguards sounds a theme well developed before INFCE's support for this idea. In a subsequent lecture to the Uranium Institute he dealt more broadly with proliferation and echoed INFCE's conclusions that there is no technical way to eliminate risk or proliferation, and that therefore the proliferation problem is solvable only when the political problems which lead countries to an interest in nuclear weapons are solved. He clearly favors this abdication of the technologists to the politicians, seeing a ritual washing of the hands by the technologists so they can proceed with a clear conscience, leaving the responsibility for dealing with untoward consequences of their work to the diplomats and politicians. Manley used INFCE to support the British interest in reprocessing and to argue the benefits for a few reprocessing centers [implicitly in Britain or in France]. One visible effect of INFCE upon his thinking is his use of the INFCE arguments for reliable nuclear supply to support optimistic prospects for international nuclear trade subject to some as yet undefined new non-proliferation conditions of supply.

Another indication of the limited effect of INFCE upon thinking of the British government is to be found in the remarks of Sir Hermann Bondi, Chief Scientists of the U.K. Department of Energy, to the Fuel Cycle Conference of the Atomic Industrial Forum in New Orleans in April 1980. Sir Hermann noted that if nuclear power is to be widely available with the required stability in the nuclear market, then concerns about proliferation must be met. There must be a consensus on conditions attached to nuclear supplies and wide agreement on the technical basis for decisions which, in turn will require continuing research and evaluation. He discounted criticisms of overly optimistic nuclear power forecasts by INFCE, saying that if the actual growth is lower, then problems identified by INFCE will only be deferred for a few years. In Bondi's assessment, as in Manley's, the establishment found support in INFCE for its position on reprocessing. Here again, the abdication of the technologists appeared in a favorable light as Bondi noted Working Group 4's observation that proliferation is primarily a political problem and that political arrangements are the foundations of the non-proliferation regime.

He agreed too, by implication, with INFCE's conclusions that it is very difficult to compare the proliferation risks of various fuel cycles and with INFCE's implicit theme that the world will have to learn to live with plutonium. Bondi too endorsed INFCE's argument that assurances of supply and assurances of non-proliferation are complementary, which in the few short months since INFCE has become a new shibboleth of nuclear advocates. Still he recognized some dimensions of the task ahead if nuclear power is to fulfill the dreams of its proponents. Of this he said.

The final and key conclusion of INFCE, which you will not find in the reports, is that INFCE has been a success. As Working Group 4 put it, "all participants have gained from their efforts to seek an agreed way to describe their views." INFCE has arrived at a technical consensus, which may not be starting or new, but which points the way forward. That is quite an achievement. But now we need to build a political consensus out of the technical consensus of INFCE, not only on the way to make nuclear energy widely available but conjointly and equally on how to minimize the dangers of proliferation. Only then is it likely that every country will see INFCE not just as a successful pursuit of agreement on the double objective or an agreed nuclear trade regime and an agreed non-proliferation regime.

Still another British reaction of INFCE appeared in the lecture of Dr. Walter Marshall, then Deputy Chairman of the U.K. Atomic Energy Authority, at the Royal Institution of February 29, 1980, immediately after INFCE. ^{74/} His central theme, which was well developed before INFCE, held that if we are to have nuclear power, then we are going to have plutonium as well. The question is not should we have it, but what is the best way to use it. His lecture explored the proposition that countries with lesser nuclear programs should be able to sell their spent fuel to the more advanced nuclear countries who would recover and use plutonium for fuel. Economic incentives rather than government controls would lead to this nuclear utopia where proliferation risks would be circumscribed by concentration of plutonium use in a few major nuclear countries, with the others using normal or slightly enriched uranium.

Again, in the case of Dr. Marshall, INFCE served not to change a school of thought, but rather was used to prop it up.

As for coverage of INFCE in the British news media, articles appeared in the Times (18 February, 27 February and 29 February); the Guardian (28 February); the Financial Times (25 February, 26 February, 28 February, and 1 March); the International Herald Tribune (25 February and 27 February); the Economist (1 March); Nature (28 February and 6 March); New Scientist (6 March); and Nuclear Engineering International (March and April). ^{75/}

^{74/} The text of the U.K. Atomic Energy Authority's press release summarizing Dr. Marshall's lecture appears in Appendix I.

^{75/} Copies of these may be obtained from the Congressional Research Service.

In the Federal Republic of Germany.--In the Federal Republic of Germany, the Government's nuclear policy was described in the "Second Projection of the Federal Government Energy Programme" prepared in response to a Parliamentary resolution of December 14, 1978. This policy incorporated reprocessing and development of the plutonium-fuelled fast breeder reactor. Since then the nuclear programme in the FRG has been, as one government spokesperson remarked to the present author, "at a standstill". This standstill has arisen, however, for internal domestic reasons, and there seems little evidence that INFCE has materially altered the position.

On April 29, 1980 Federal Chancellor Helmut Schmidt tabled before the Federal Parliament the INFCE report and a German translation of the original English text of the Summary. He said only that in respect to the official policy "the Federal Government ascribes special significance to the results of INFCE". He did not offer any further details. The Federal Government issued a statement which interpreted INFCE as confirming its national and international nuclear policies with respect to the backend of the nuclear fuel cycle, including reprocessing, deployment of the fast breeder, and the government's international nuclear energy policy. 76/

Another more specific indication of the West German government's reaction appeared in an article by Dr. Werner Ungerer, a Deputy Assistant Secretary in the Bonn Foreign Office. Writing in *Aussenpolitik*, he said: 77/

It was not without importance for the Federal Republic of Germany that the essentials of its atomic energy policy were reaffirmed. This was true of its nuclear waste disposal concept, based on intermediate storage of spent fuel, reprocessing and final storage of radioactive waste in underground salt deposits. It was also true of the fast breeder option and Bonn's export policy, based on including as many countries as possible that are interested in using atomic energy in a system of cooperation and joint responsibility for the strictly peaceful utilization of atomic energy.

Dr. Ungerer identified a number of problems for the post-INFCE era, including dealing with the United States under constraints of its nonproliferation act, the export of sensitive nuclear plants and technology, varying requirements for full scope safeguards, exercise of rights of prior consent, renegotiation of agreements for nuclear cooperation, and the IAEA's work on a plutonium storage regime. Overarching these is a basic question of non-proliferation policy as a whole: what is the balance between rights and duties of nuclear weapons and non-nuclear weapons states? INFCE was unable to answer this fundamental question. He anticipated that relations between nuclear

76/ The text of this statement appears in Appendix I.

77/ Werner Ungerer. International nuclear order before and after INFCE. *Aussenpolitik*, vol. 31, Nov. 3, 1980, p. 255. Note, excerpts from Dr. Ungerer's paper appear in Appendix 1.

supplier and recipient countries would be an issue likely to dominate international nuclear discussions in the months ahead. Out of this list of problems emerged a pessimistic view: 78/

It is hard to see how, against this background, a stable international nuclear order based on widespread consensus can be expected to evolve and link in an ideal combination free nuclear trade on one hand and the prevention of atomic energy on the other . . . Political common sense will be needed to prevent exaggerated non-proliferation demands from leading to a proliferation of the capacity of manufacture nuclear explosive devices unhampered by international controls.

In the official view one can but hope that in the months ahead a healthy balance is struck on the basis of the INFCE findings between measures to prevent further proliferation on nuclear weapons and as undisturbed as possible a development of atomic energy for peaceful purposes.

In France.--In France the government's nuclear policy includes vigorous development of reprocessing and the fast breeder reactor. These continue apace, without any indication that INFCE prompted even minor revision. According to the Commissariat à l'Energie Atomique, the only official French statement about INFCE was an interview with M. Giraud, Minister for Industry and former head of the CEA, published in the *International Herald Tribune* 30 January 1980. 79/ Nuclear opponents in France do not appear to have published any formal comments on INFCE.

In the Netherlands.--In July 1980 the Netherlands Government sent to its Second Chamber of Parliament a report of the Government's policy conclusions from INFCE. 80/ The major conclusion seen to emerge from INFCE was that, in varying degree, all fuel cycles contain sensitive and less sensitive stages in respect to proliferation, and that the sensitivity is also dependent on the time. If appropriate measures are taken, no particular cycle deserves to be ruled out for reason of proliferation, nor are there any cycles with no proliferation risks. Concerning plutonium and fast reactors, on account of the highly uncertain nature of future energy supplies, the Government considered it would be irresponsible to reject the fast reactor option. However, new measures must be taken to minimize the possible misuses of the fast reactor cycle. Use of plutonium in thermal reactors has more disadvantages than advantages and was therefore rejected for the present. Nonetheless, the Government saw no

78/ Ibid., p. 259

79/ The text of this interview appears in Appendix I.

80/ Excerpts from the English version of this report appear in Appendix I.

justification for rejecting reprocessing provided there are sufficiently effective safeguards. In its conclusion, the report came again to the political issues of proliferation, saying:

The Government is aware that making the nuclear infrastructure as resistant as possible to misuse does not constitute a final solution to the problem of proliferation. Given the unpreventable dissemination of nuclear know-how, the manufacture of nuclear weapons is largely a political decision, related among other things to the continuing nuclear arms race among the existing nuclear weapons states. Rendering the civil fuel cycle as proof as possible against misuse does, however, increase the technical and political barriers to the acquisition of nuclear weapons. A civil fuel cycle of this kind is also important in terms of preventing the possible misuse of sensitive nuclear materials by sub-national groups.

In Euratom.--As for the reactions among the Euratom states, the Commission of the European Communities on June 11, 1980 published a report on INFCE to its Council. This report was notably self congratulatory, as is evidenced in the following excerpt from its conclusion:

The results of INFCE have by and large confirmed that the Community position is justified in not confining itself to recommending that thermal reactors be operated but also aiming at keeping open the option of recycling plutonium in thermal and fast reactors; this in turn implies the reprocessing of irradiated fuels.

The report's final remarks indicated little overall effect of INFCE upon the thinking of the Community. Here the report said:

Accordingly, its [The Community's] course of action in the forthcoming bilateral and multilateral negotiations must steadfastly uphold the principle of non-interference in the free choice of technologies, provided, of course, that the latter are utilized with due regard to the non-proliferation obligations that have been entered into.

In the IAEA.--Shortly after INFCE concluded, Mr. David A. V. Fischer, then Assistant Director General for External Relations of the IAEA addressed the Japan Atomic Industrial Forum Conference on INFCE and the role of the Agency. ^{81/} He made the following six points which show the Agency's

^{81/} D. A. V. Fischer. Post INFCE and the role of the IAEA. Remarks at the 13th Annual Japan Atomic Industrial Forum Conference, March 5, 1980.

anticipation that evolution of nuclear power will continue with little change from INFCE. Briefly summarized, these points were:

1. INFCE confirmed that the nuclear industry took the right decision in the 1950's to introduce thermal power reactors and to proceed from these, through commercial reprocessing, to the commercial use of fast breeders by the end of the century.
2. INFCE showed this evolution does not bring with it significantly greater proliferation risks than the once-through or throw-away cycle, or other more exotic fuel cycles, and that technical fixes can do little to reduce proliferation risks.
3. INFCE replaced the incipient confrontation of the mid-1970's with consultation involving all interested states.
4. INFCE encouraged the Agency's work on international plutonium storage and international spent fuel management.
5. INFCE gave useful pointers for strengthening safeguards.
6. INFCE began an important discussion on supply assurances and policies, which represents the main unfinished business that INFCE left for the Agency.

Against the background of these six points, Mr. Fischer suggested that a realistic policy for the 1980s should take account on three considerations:

1. A country that invests heavily in a nuclear power plant should at least be certain that the supply of nuclear fuel under accepted international safeguards will be assured for the lifetime of the plant.
2. The "reprocessing cat" has been out of the bag since 1955, and all our efforts cannot put it back. In fact, it looks as if the "enrichment cat" is also crawling out of the bag.
3. The decision to acquire nuclear weapons is a political one. So the main barrier to proliferation remains the political will. The top priority for non-proliferation is to bring all countries into the non-proliferation regime of the NPT or the Treaty of Tlatelolco, or to accept full scope safeguards. "Concern about the inevitable spread of sensitive technologies must not blind us to this reality or deflect us from pursuing this cardinal objective."

CHAPTER 4: POSSIBLE REASONS FOR INFCE's MINIMAL EFFECTS

It can be seen from the preceding that the effects of INFCE in Europe have been minimal and at best oblique. Governments and industries regarded its outcome as confirmation of their original views and endorsement of their original policies. Those critical of nuclear power developments dismissed INFCE virtually without comment. Why should this have been so? Why should an exercise widely billed as the most comprehensive and detailed study of nuclear power ever undertaken pass almost as though it had never taken place? Some possible reasons are adduced below. This analysis must of necessity be speculative; but it may nevertheless provide food for thought among those who have to resolve the issues which continue to envelope nuclear power worldwide. The official reactions to INFCE, such as they were, can be documented. It is, however, difficult to document absence of reactions. Many of the following comments are accordingly a distillation of views gathered in personal conversations, and must be accepted or rejected as such. They are, nevertheless, indicative of significant attitudes and reactions, and may thus deserve consideration.

INFCE as a political exercise.--INFCE was summoned into being essentially to defuse a specific and embarrassing conflict between the United States and its European and Japanese allies over the appropriate way to minimize the possibility of proliferation of nuclear weapons as a consequence of the civil use of nuclear power, especially the commercial use of plutonium as a nuclear fuel. The original premise upon which INFCE was set up was the suggestion that there might be ways to generate nuclear electricity which did not embody such potential hazards. INFCE was conceived as a way of identifying and comparing different routes for the generation of nuclear electricity. The comparison was to be primarily technical, not economic or political. However, at least unofficially, neither governments nor the nuclear industries, nor nuclear critics took this premise at face value. INFCE was seen in every quarter as fundamentally a political exercise. Moreover, its terms of reference explicitly excluded consideration of those issues of health, environmental or safety which had given rise to opposition from outside governments and industries. Instead, INFCE was a study set up and carried out by those convinced of the value of nuclear generation of electricity to resolve disagreements as to how best to proceed. The issue was not whether to proceed with nuclear power but only how.

Failure of INFCE to resolve disagreements.--INFCE had been expected to report in 1979. The delay to February 1980 arose because of the difficulty of achieving agreed statements on issues raised. These disagreements could not realistically be called narrowly technical. They were political and were so perceived from all quarters. The final report, far from resolving these disagreements appears essentially to wash its hands of them, describing them as not technical but political, and therefore outside the terms of reference of INFCE. Critics of nuclear development who followed the progress of the INFCE deliberations tended to characterize its outcome as the lowest common

denominator of agreement among the international nuclear establishment, it was a general endorsement, amounting almost to rubber-stamping, of previous viewpoints and policies. From the European vantage point, the consensus reached by INFCE was achieved essentially by forcing the United States to move from its stated position of 1976-77 about the proliferation hazards associated with certain nuclear technologies. Evidence of the difference between statement and practice of U.S. nuclear policy--the authorization of transfer of spent fuel for reprocessing, the President's acquiescence to licensing nuclear fuel exports for India's Tarapur reactors, and the continuing large U.S. Federal Budget allocations for fast breeder reactor research, all were regularly cited during and after INFCE as indication of U.S. ambivalence, or worse.

INFCE's limited audience.--INFCE was seen by its participants as a process of "education". Put more bluntly, each side--broadly speaking the United States versus the rest--wanted to teach the other side a lesson. INFCE was not, however, addressed to those outside the nuclear circle of governments and industries. In the United Kingdom, for instance, the INFCE report itself--consisting of eight volumes, some costing £15 each, was virtually inaccessible to the general public. It would only be purchased from the International Atomic Energy Agency in Vienna. Even interested journalists and other commentators had to make special arrangements to view those few copies available in the United Kingdom. The INFCE summary was some eighty pages in length and was couched at such a level of generality that it offered little substance for analysis or discussion. Clearly, INFCE's organizers did not conceive of a significant role for INFCE in public nuclear policy in Europe, nor has one arisen.

INFCE's re-run of pro-nuclear arguments and the absence of outside participation.--Critics also pointed out that despite insistence that INFCE was a technical study and only a technical study, its final report showed no reluctance to address issues of energy policy in general. Indeed, the report postulated demand for electricity and nuclear power in the future at a level substantially higher than other official projections. In this and other respects, INFCE was seen by those critical of nuclear developments as essentially a re-run of arguments long since familiar from other arenas--for instance at the British Windscale and the West German Gorleben inquiries. Since INFCE made no provision for input from outside the international nuclear community, its conclusions and observations appear from outside to be both predictable and unconvincing. Some critics noted that INFCE's technical findings could imply an alternative conclusion entirely: that if all routes to nuclear electricity bear similar weapons proliferation hazards, perhaps it would be advisable to phase out nuclear electricity worldwide, altogether and as quickly as possible.

Public concern with existing, not prospective, nuclear weapons.--In any event, the weapons implications of civil nuclear power have in recent months been superseded as a matter for European public concern. The focus of concern is now those nuclear weapons already possessed by governments, and whose use seems to become ever more imminent. In the light of such a prospect, Europe seems long since to have all but forgotten that INFCE ever took place.

PART IV: THE EUROPEAN REACTION SUMMARIZED AND SOME IMPLICATIONS FOR
U.S. NONPROLIFERATION POLICY

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CHAPTER 1: SUMMARY OF EUROPEAN RESPONSES

The analyses of European reactions to the International Nuclear Fuel Cycle Evaluation by Geoffrey Greenhalgh and Walter Patterson show a low keyed response in Europe. However, during coming years INFCE will be referred to as providing the technical basis against which nuclear policies will be judged.

Two conclusions of INFCE, already appear to have become part of conventional wisdom in Europe. The first is implicit. As phrased by Greenhalgh,

The most significant conclusion to emerge from INFCE is that preventing further proliferation of nuclear weapons is primarily a political problem.

The second is INFCE's explicit conclusion that assurances of nonproliferation and assurances of nuclear supply are complementary. The statement of an inalienable right to use nuclear energy is accepted, with its corollary that discrimination in supply is undesirable. But the European reaction to INFCE also reveals an increased awareness of risks that material and facilities from civil nuclear power might help a government quickly to acquire nuclear weapons. On this point the concern is not as great as has been voiced in some quarters in the United States. Reliance on institutional measures to limit future proliferation likewise appears well accepted, although it seems to be limited for the near future to international storage of spent nuclear fuel and international storage of plutonium.

On the whole, the European reaction is acceptance of INFCE's conclusions and also a sense that INFCE has confirmed existing national policies for development of nuclear power and conditions for nuclear trade. And, the European governments and nuclear industries appear to accept INFCE's optimism for the future of nuclear power in Europe, in other industrialized countries, and in the developing nations. The public, however, appeared quite unaware of INFCE's optimism.

Parliamentary.--European parliaments were informed of INFCE. Some received summaries and a few received government commentaries. Notable among these was the report to the parliament of the Netherlands which showed INFCE as supportive of the policies of that Government and as not requiring any notable change for the future of Dutch nuclear power. There were no major parliamentary debates or inquiries.

Governmental.--The governments, as shown by Greenhalgh and Patterson, tended to see INFCE as confirming their existing policies for domestic development of nuclear power and their conditions for nuclear trade, and as offering an oblique criticism of U.S. policy. The government responses indicated confidence that plutonium can be produced and used for a nuclear fuel within acceptable proliferation risks. However, the judgment that reprocessing for economic reasons would be concentrated in a few, large plants, perhaps internationally owned, lends some support to thinking here. IAEA safeguards were supported as was their further improvement for applications to production and use of plutonium. The formation of the IAEA's Committee on Assurance of Supply received favorable comment.

Industrial.--The European nuclear industries have shown little visible reaction to INFCE. They apparently see in INFCE confirmation of the wisdom of their commercial goals and interests in conventional nuclear power reactors, in breeders, and in reprocessing.

Public.--The treatment of INFCE by the press was minimal and the availability of information on what happened at INFCE was low. Press coverage in Europe was considerably more than the minimal attention INFCE received in the United States, but it was comparatively little in terms of the time and effort invested in the Evaluation. Moreover, as Patterson points out INFCE reports themselves were not readily available to the public. The only access for the European public was to order expensive copies from Vienna.

Little known to the public, INFCE had little effect upon public attitudes toward nuclear power. The various European publics appeared largely unaware of INFCE's proceedings and its reports. Moreover, INFCE had little effect on the divisions within the publics over nuclear power Patterson called attention to this dearth of attention by those critical of or opposed to nuclear power. His brief survey revealed "scarcely a jot of evidence" of interest in INFCE, much less any reaction to it, and he quotes a government official as calling INFCE a "non-event." As for reasons for this minimal effect of INFCE, Patterson sees them as including perception of INFCE as a political exercise, failure of INFCE to address and resolve certain disagreements, the limited audience which INFCE addressed, the exclusion of those outside of the nuclear circle, and a tendency of INFCE participants to re-play the arguments of nuclear proponents with scant attention to differing views of nuclear critics.

An unexpected diplomatic benefit.--Patterson sees INFCE as having had a perhaps unintended beneficial effect of lowering the temperature of the diplomatic atmosphere for international nuclear affairs which in 1977 had become tense and suspicious, and riddled with mutual distrust and declining confidence. Many Europeans considered INFCE to have been worthwhile simply for its cooling effect on this temperature and its improvement of the atmosphere for international nuclear diplomacy.

CHAPTER 2: A SUMMARY COMPARISON OF THE TWO ANALYSES

The analyses of European reactions to the International Nuclear Fuel Cycle Evaluation by Geoffrey Greenhalgh and Walter Patterson reflect radically different perspectives. Greenhalgh, a proponent of nuclear power, focused on the positive reactions of those who favor nuclear energy in Europe. On the other hand, Patterson, a leading critic of nuclear power who is associated with the British branch of Friends of the Earth, sought to explain the silence and suspicion of the opponents of atomic power, and INFCE's "minimal and at best oblique" effects. Taken together, Greenhalgh and Patterson offer insights into the reactions and responses to INFCE by European governments and nuclear industries, media and publics, and the opponents of nuclear power. And, their analyses agree on many points of fact, even if their choice and interpretations of those facts differ.

Reactions of governments and nuclear industries.

After INFCE, no government has stopped construction of enrichment or reprocessing plants. No government has abandoned or substantially changed existing programs to develop and demonstrate breeder reactors. No government has agreed to forswear recycle of plutonium in thermal reactors, although many have conceded the economics are not favorable. No government has changed any laws or regulations that require the reprocessing of spent fuel from conventional nuclear power plants as a necessary step in nuclear waste management, despite INFCE's conclusion that reprocessing is not necessary for this purpose. No supplier government has notably changed its conditions for nuclear exports or control over their subsequent use. And the nuclear industries in Europe, aside from speeches at various meetings on nuclear energy, have shown little visible interest in INFCE.

European governments and nuclear industries did not change their policies because of INFCE; indeed changes were believed to be unnecessary. In Europe, both government and industry saw INFCE as confirming existing national policies for the development of nuclear power and the conditions of nuclear trade. After all, the most controversial aspect of European nuclear policies (from the perspective of the United States) was the development and export of breeder and reprocessing technology. From their perspective, INFCE's conclusions could justify the further development of the plutonium fuel cycle, and to argue that this would not substantially increase proliferation risks, for INFCE held proliferation to be a political rather than a technical problem.

Moreover, INFCE's recommendations concerning the desire of the Third World for predictability and reliability in nuclear supply arrangements, and for negotiations rather than unilateral imposition of non-negotiable contract changes, evoked European sympathies that combined economic needs and perceived benefits with oblique criticism of the U.S. The Europeans are of one mind with many representatives of Third World nations on INFCE's explicit conclusion that assurances of nonproliferation and assurances of supply are complementary. Both accept the statement of an inalienable right to use nuclear power, with its corollary that discrimination in supply is undesirable. And, both share INFCE's optimism for the future of nuclear power in the developed and developing world.

Greenhalgh and Patterson recognize that Europeans see INFCE as supporting their interests and policies. Greenhalgh, however, views the conclusion of INFCE as a positive, pronuclear contribution, which could influence international nuclear developments for years to come. Patterson, on the contrary, sees the INFCE proceedings merely as a ratification of the status quo ante, which was not altered in any fundamental way.

Reactions of the public and the critics of nuclear power.

The consideration of public reaction to INFCE must, first, look at the coverage of the evaluation by the press, and the availability of information on its proceedings and conclusions. Second, it must look at the public response itself.

From Greenhalgh and Patterson, it appears that the press coverage of INFCE in Europe was considerably more extensive than the minimal attention it received in the United States. This coverage, however, was much less than the European coverage of the U.S. nuclear accident at Three Mile Island in March, 1979. Moreover, the European press probably treated INFCE in a more detailed and balanced way than its American counterpart. Whatever the nature of the coverage, the print media was essentially the sole source of public access to the proceedings. As Patterson pointed out, the INFCE reports themselves were not readily available to the public. The copies printed by the IAEA wound up mainly in government or industry. No government reprinted the INFCE reports or the summary of the Conference's conclusions for public information, nor were any digests published. The only access for the European public was through expensive copies that could be ordered from Vienna.

The public reaction in Europe reflected this ignorance of the public, or perhaps merely its indifference. There were no signs of a major response. No debates were reported, no public organizations announced any change in views on nuclear power and proliferation. There were no demonstrations, no manifestoes, no clamors, not even by concerned citizens and committed activists. Instead there was mainly silence.

If there were qualified agreements in Patterson's and Greenhalgh's assessments of the reactions of the European governments and nuclear industries, the same cannot be said for the reactions of the various European publics, or that of European organizations committed to the antinuclear cause. Patterson considered these matters explicitly; Greenhalgh did not. The latter neither mentioned the antinuclear movement, nor referred to any public apprehensions of nuclear power, nor did he consider the general public. His only mention of the media is a passing remark on the tendency to regard INFCE in "gladitorial terms" and to view its outcome as a defeat for the U.S. Such coverage for Greenhalgh represented an extreme view and reflected the problem of journalists trying to dramatize lengthy, complex technical proceedings. This remark, as well as his silence, may suggest that INFCE had little effect outside of governmental and industry circles, because it was highly technical and unintelligible to the general public. Patterson would agree that INFCE had essentially no public effect. He suggests, however, that public involvement was neither intended or desired. For him, the reasons activists ignored the Conference were: their perception of INFCE as a political exercise; the exclusion of issues that had given rise to opposition to nuclear power; and the tendency of INFCE participants to re-play the arguments of nuclear energy's supporters.

A defeat for the United States?

Greenhalgh noted but discounted European reactions that INFCE's outcome was a defeat for the United States. Of this he said:

There has always been a tendency to regard INFCE in gladiatorial terms with the United States against the other participants. A belief that the whole purpose of the exercise was to justify the U.S. policy of no-reprocessing and no-fast breeder was seen by some to be implicit in President Carter's expectation that INFCE was to seek "options and alternatives to reprocessing and recycle that have been long overlooked or forgotten" 82/

Viewed in these terms, some commentators saw the outcome of INFCE as a defeat for the United States. The Financial Times of 25th February, 1980 under the headline "Opposition to U.S. Nuclear Plans," observed that the participating nations had "... refused to endorse U.S. Government policies for control of nuclear proliferation." The Observer, working from an early leak, claimed on 27th January, 1980 "Report hits Carter's nuclear waste policy." From Italy, the Corriere della Sera, 1st March, 1980 reported "Carter beaten: 500 experts say 'yes' to plutonium power stations".

82/ Greenhalgh, p. 23.

These are however extreme views, and reflect the problem of the journalist seeking to dramatize a two year, highly complex technical and exhaustive study which has been described as the most comprehensive evaluation of a technology ever undertaken. 83/

Patterson, on the other hand, saw INFCE as a victory for established European nuclear policy:

From the European vantage point, the consensus reached by INFCE was achieved by forcing the United States to move from its stated position of 1976-77 about the proliferation hazards associated with certain nuclear technologies. 84/

The significance of INFCE.

Was INFCE a significant event in Europe?

According to Greenhalgh, it was:

Its [INFCE's] completion has provided a common factual background, a solid agreed data base on which decisions can be taken 85/

INFCE can be expected to have some influence in the future:

There can . . . be little doubt that the conclusions of INFCE will be frequently and forcibly represented in the coming years, particularly on questions of the availability, security, and stability of uranium supply; on reprocessing, which INFCE characterized as the essential preliminary to many of the possible fuel cycles; and on plutonium recycle in thermal and fast reactors 86/

Also: "INFCE can . . . be seen as a turning point." 87/

83/ Ibid., p. 24.

84/ Patterson, p. 55.

85/ Greenhalgh, p. 14.

86/ Ibid.

87/ Ibid., p. 35

Moreover, for Greenhalgh, INFCE made positive contributions to the international atmosphere surrounding the nuclear nonproliferation debate. As well,

it has given an impetus to three useful initiatives: the international plutonium storage scheme, the international storage of spent fuel and/or waste, and the proposal to work out an acceptable international set of rules for assurance of essential nuclear supplies. 88/

In contradistinction to Greenhalgh, Patterson denies INFCE was significant. He wrote:

In Europe the effects of INFCE on [governments, nuclear industries, concerned organizations, and the public] have been essentially negligible, if not non-existent. Indeed, in a personal conversation with the author of this report, one highly placed spokesperson for the United Kingdom Atomic Energy Authority characterized INFCE as a non-event. To the extent that INFCE had any perceptible effect at all, it served merely to reinforce the established attitudes of all the above-named groups, whatever their attitudes to nuclear power. 89/

Nevertheless, Patterson discerned one positive effect of INFCE, which was an improved diplomatic atmosphere. As he put this point:

One major positive effect of INFCE nevertheless can be identified, which paradoxically, is unrelated to INFCE's observations and conclusions. The diplomatic atmosphere surrounding international nuclear affairs by 1977 had become tense and suspicious, and was riddled with mutual distrust and declining confidence. INFCE provided an interlude during which those involved in international nuclear discourse were able once again to reestablish lines of reliable communication. . . . INFCE may have done little if anything to resolve outstanding points of controversy; but it lowered the temperature of the discussion and cleared the atmosphere. The problems of 1977 still remain; indeed, some have since become more acute and others have developed new dimensions. Nevertheless, many Europeans consider INFCE to have been worthwhile simply for its effect on the psychology of international nuclear diplomacy. 90/

88/ Ibid., p. 22.

89/ Patterson, p. 44.

90/ Ibid., p. 67.

CHAPTER 3: SOME COMPARATIVE EXCERPTS

The reader who would compare in more detail what Greenhalgh and Patterson had to say about European reactions to INFCE will find illumination in the following selected excerpts from their analysis. The excerpts deal with general reactions, the use of plutonium as a fuel, industry reactions, public reactions, assurances of supply and political barriers to further spread of nuclear weapons. For some of these broad topics, one author may have said little while the other commented at length. This imbalance is instructive of the different viewpoints of the authors.

General reactions.

The following excerpts from Greenhalgh and Patterson address the general nature of the European reaction to INFCE.

Greenhalgh.--

For the industrial countries of Europe, the main concern was about the availability and reliability of supplies of uranium - "the most political of all commodities." In the short term this calls for clear, unambiguous rules to govern the supply of nuclear material equipment and technology.

* * *

In the longer term, the ultimate goal is the introduction of the fast breeder reactor where, as seen by INFCE: a power system of fast reactors with an adequate breeding gain could provide freedom from uranium supply constraints over a period of many hundreds of years.

For the European countries increasingly dependent on nuclear power but lacking any rich indigenous uranium resources, the lure of independence offered by the fast reactor is irresistible. And this is now backed with the added approbation of INFCE that in comparison with the LWR fuel cycle, the FBR fuel cycle appears to confirm and to enhance the advantages of nuclear power to both the environment and the population. 91/

91/ Greenhalgh, pp. 17-18.

. . . INFCE can, and no doubt will, be interpreted [by the Europeans] as legitimizing almost all peaceful nuclear aspirations [that is, as legitimizing European governmental policies] 92/

Patterson.--

. . . in Europe . . . [g] overnments and industries regarded its [INFCE's] outcome as confirmation of their original views and endorsement of their original policies. 93/

The use of plutonium as a fuel.

While Greenhalgh and Patterson have diametrically opposed views on the wisdom of using plutonium as a nuclear fuel, as can be seen in the following excerpts, both look to INFCE for support.

Greenhalgh.--

The widespread support in Europe for continuing development of the fast reactor was endorsed at a recent meeting of the Foreign Secretaries of the European Economic Community countries which approved the techniques of reprocessing and breeding, thus acknowledging their role in decreasing the energy dependence of their countries. The need to recycle plutonium has long been a plank of the EEC nuclear policy, and it was to be expected that the Commission's view was that "the results of INFCE have by and large confirmed that the Community position is justified in . . . keeping open the option of recycling plutonium in thermal and fast reactors; this in turn implies the reprocessing of irradiated fuels." 94/

* * *

A number of European countries, notably Belgium, West Germany, Italy and Switzerland and possibly Sweden, also looked to recycling of plutonium in thermal reactors. 95/

92/ Ibid., p. 24.

93/ Patterson, p. 54.

94/ Greenhalgh, p. 26.

95/ Ibid., p. 27.

Patterson.--Patterson focused on the reactions of specific countries and international organizations, notably Euratom, The Federal Republic of Germany, the Netherlands and the United Kingdom, as follows:

Euratom

. . . the Commission of the European Communities on June 11, 1980 published a report on INFCE to its Council. This report was notably self congratulatory, as in evidenced in the following excerpt from its conclusion: "The results of INFCE have by and large confirmed that the Community position is justified in not confining itself to recommending that thermal reactors be operated but also aiming at keeping open the option of recycling plutonium in thermal and fast reactors; this in turn implies the reprocessing of irradiated fuels." 96/

The Federal Republic of Germany

The Federal Government issued a statement which interpreted INFCE as confirming its national and international policies with respect to the backend of the nuclear fuel cycle, including reprocessing, deployment of the fast breeder, and the governments international nuclear energy policy. 97/

The Netherlands

In July 1980 the Netherlands Government sent to its Second Chamber of Parliament a report of the Government's policy conclusions from INFCE. The major conclusion seen to emerge from INFCE was that, in varying degree, all fuel cycles contain sensitive and less sensitive stages in respect to proliferation, and that the sensitivity is also dependent on the time. If appropriate measures are taken, no particular cycle deserves to be ruled out for reason of proliferation, nor are there any cycles with no proliferation risks. Concerning plutonium and fast reactors, on account of the highly uncertain nature of future energy supplies, the Government considered it would be irresponsible to reject the fast reactor option. However, new measures must be taken to minimize the possible misuses of the fast reactor cycle. Use of plutonium in thermal reactors has more disadvantages than advantages and was therefore rejected for the present. Nonetheless, the Government saw no justification for rejecting reprocessing provided there are sufficiently effective safeguards. 98/

96/ Patterson, p. 52.

97/ Ibid., p. 50.

98/ Ibid., pp. 51-52.

The United Kingdom

. . . in Bondi's [Sir Hermann Bondi, Chief Scientist of the U.K. Department of Energy] assessment, as in Manley's [Mr. Ivor T. Manley, Under-Secretary for Atomic Energy in the U.K. Department of Energy], the establishment found support in INFCE for its position on reprocessing. 99/

. . . in the case of Dr. Marshall [former Deputy Chairman of the U.K. Atomic Energy Authority], INFCE served not to change a school of thought [advocating the utilization of plutonium], but rather was used to prop it up. 100/

Reactions of the nuclear industries.

For European nuclear industries, too, INFCE confirmed existing plans for the development of nuclear energy, specifically reprocessing and breeder technology. There were, then, no fundamental alterations of policy.

Greenhalgh. --

For the nuclear industry [in Europe] the main concern is over the supply of uranium and the extreme sensitivity of nuclear trade to sudden changes in government policies. Representations on this point were made to INFCE by the Uranium Institute, a body which brings together both the producers and consumers from eleven different countries. 101/

The institute [i.e., the Uranium Institute] urged greater predictability and certainty in nuclear commerce, saying: ". . . The industry thus particularly supports the views of INFCE's Working Group 3, which argues strongly for greater predictability in nuclear commerce based on long-term contracts; and for the reduction of uncertainty in the application of controls over exports (and, where appropriate, imports) in nuclear trade, in as uniform and foreseeable a manner as possible." 102/

99/ Ibid., p. 48.

100/ Ibid., p. 49.

101/ Greenhalgh, p. 31.

102/ Ibid., p. 32

And,

. . . the [Uranium] Institute opposed the case-by-case approach by nuclear suppliers [and believes elements of its rationale have been "explicitly or implicitly recognized by INFCE"]. 103/

Also,

From the viewpoint of the uranium industry, INFCE was regarded as a major contribution to clarifying the issues of non-proliferation. 104/

INFCE . . . drew attention to the need for further improvements in safeguarding materials that could be directly used for nuclear weapons, a view . . . the [Uranium] Institute supported. . . . 105/

Patterson.--

Nuclear industry spokespeople make occasional passing reference to INFCE as offering no hindrance to particular plans and proposals . . . 106/

Reactions of the European publics

For the European public at large, and for Europeans committed to a critique of nuclear power, INFCE produced virtually no visible effects.

Greenhalgh.--

No relevant text.

Patterson.--

A review of the popular press . . . shows no evidence that the European public however defined, either knew or cared that INFCE was taking place or about its observations and conclusions. The effect of INFCE on the European public can without exaggeration be given as nil. 107/

103/ Ibid.

104/ Ibid., p. 31.

105/ Ibid., p. 34.

106/ Patterson, p. 45.

107/ Ibid., p. 46.

INFCE was not . . . addressed to those outside the nuclear circle of governments and industries . . . Clearly, INFCE's organizers did not conceive of a significant role for INFCE in public nuclear policy in Europe, nor has one arisen 108/

A random but extensive survey of the periodicals and other publications produced by these [organizations other than government and the nuclear industry] reveals scarcely a jot of evidence indicating even an awareness that INFCE had reported, much less any reaction to its conclusions and observations. No U.K. environmental organization, peace organization or other group or individual critical of civil nuclear policy saw fit to publish formal comment on the outcome of INFCE. 109/

Those critical of nuclear power developments dismissed INFCE virtually without comment. 110/

Critics of nuclear development who followed the progress of the INFCE deliberations tended to characterize its outcome as the lowest common denominator of agreement among the international nuclear establishment. It was a general endorsement, amounting almost to rubber-stamping, of previous viewpoints and policies. 111/

* * *

. . . INFCE was seen by those critical of nuclear developments as essentially a re-run of arguments long since familiar from other arenas -- for instance at the British Windscale and the West German Gorleben inquiries. Since INFCE made no provision for input from outside the international nuclear community, its conclusions and observations appear from outside to be both predictable and unconvincing. Some critics noted that INFCE's technical findings could imply an alternative conclusion entirely: that if all routes to nuclear electricity bear similar weapons proliferation hazards, perhaps it would be advisable to phase out nuclear electricity worldwide, altogether and as quickly as possible. 112/

108/ Ibid., p. 55.

109/ Ibid., p. 46.

110/ Ibid., p. 54.

111/ Ibid., pp. 54-55

112/ Ibid., p. 55.

Assurances of supply.Greenhalgh.--

. . . the Commission of the European Communities commented to its council that: "The concern in Europe are also directed more towards reliability of supply and non-discrimination in the peaceful uses of nuclear energy. And here it has been noted by the EEC that INFCE has not succeeded in "allaying fears that trade in the nuclear sector would continue to be distorted or even disrupted, by the unilateral action of certain governments . . . the risk that certain technologies (for example, plutonium recycling in thermal reactors) would be subject to discriminatory treatment is still with us." 113/

* * *

There was . . . dissatisfaction [in Europe] with the restrictions imposed by the informal "London Club" of nuclear supplier states. The case against such discriminatory policies was spelled out by INFCE Working Group 3. "Assurance of supply and assurance of non-proliferation are thus complementary. Not only do effective non-proliferation assurances facilitate supply assurance but the non-proliferation commitments of any country may be considered stronger to the extent that such a country relies on international markets for a part of its nuclear supplies. Assurance of supply could also reduce pressures for a worldwide spread of enrichment and reprocessing facilities, even though these may be ultimately required to meet national needs."

The same view was expressed by the International Consultative Group on Nuclear Energy . . . [co-sponsor of which was the Royal Institute of International Affairs, London] which early in 1980 called for: "A new bargain of confidence in which credible guarantees of peaceful purpose will be balanced by firm assurances of access to nuclear services, materials and technology." 114/

113/ Greenhalgh, p. 16.

114/ Ibid., p. 17.

Patterson.--

[Mr. Manley stated] that if assurances of supply are to be one side of the new bargain for reliable nuclear supplies, safeguards will be the other . . . [Patterson understood this to mean that] one visible effect of INFCE upon his thinking is his use of the INFCE arguments for reliable nuclear supply to support optimistic prospects for nuclear trade subject to some as yet undefined new non-proliferation conditions of supply. 115/

Political barriers to the spread of nuclear weapons.

While the proposition that the best solution to the proliferation problem is removing reasons for governments to want nuclear weapons was circulating well before INFCE, this international analysis gave strong reinforcement to it, as is evident in the following excerpts from the analyses of Greenhalgh and Patterson.

Greenhalgh.--

There is wide agreement in Europe that the problems of proliferation are more of a political nature than technical. INFCE was seen as underlining the fact that a government's decision to equip itself with nuclear weapons is essentially political and prompted by reasons of national security, and that the peaceful use of nuclear energy is neither the easiest nor most economic method of manufacturing nuclear weapons. 116/

* * *

INFCE is seen in Europe as having provided a wider and better understanding of the problems of proliferation 117/

Patterson.--Patterson focused on the British view of this proposition, as follows:

. . . [Mr. Manley's] call for the diplomatic community to work for the widest acceptance of full scope safeguards sounds like a theme well developed before INFCE's support for this idea . . . He [subsequently] dealt more broadly with proliferation and echoed INFCE's conclusions that there is no technical way to eliminate risk of proliferation, and that therefore the proliferation problem is solvable only when the political problems which led countries to an interest in nuclear weapons are solved. 118/

115/ Patterson, p. 48.

116/ Greenhalgh, p. 21.

117/ Ibid., p. 22.

118/ Patterson, p. 48.

[Sir Herman] Bondi noted Working Group 4's observation that proliferation is primarily a political problem and that political arrangements are the foundations of the non-proliferation regime. He agreed too, by implication, with INFCE's conclusions that it is very difficult to compare the proliferation risks of various fuel cycles . . . Bondi too endorsed INFCE's argument that assurances of supply and assurances of non-proliferation are complementary, which in the few short months since INFCE has become a new shibboleth of nuclear advocates. [He stated:] . . . now we need to build a political consensus out of the technical consensus of INFCE . . . on how to minimize the dangers of proliferation.

119/

119/ Ibid., pp. 48-49.

CHAPTER 4: EUROPEAN REACTIONS WITH IMPLICATIONS FOR U.S. NONPROLIFERATION POLICY

The European reactions to INFCE, suggest several implications for the future evolution of U.S. non-proliferation policy. Bearing in mind that looking for implications is subjective and conjectural, and that others may see still other implications, the following are offered to suggest to the Congress some of the longer term effects of INFCE upon the future definition and carrying out of U.S. policies.

A greater understanding of proliferation risks.--U.S. nuclear trading partners are likely to be more understanding of United States' concern over risks that growing and evolving use of nuclear energy can increase risks of the spread of nuclear weapons. However they appear unlikely to see these risks as dangerous as we do.

More reliance on political measures.--The United States can expect other countries to use INFCE as argument for reliance on political measures to constrain future proliferation risks, and to discount reliance on developing one or another fuel cycle because of proliferation resistance.

Continued development of the breeder.--Other countries, particularly in Europe, will use INFCE's conclusions to support their continued development, demonstration and commercialization of the plutonium breeder with its attendant production and use of plutonium as a fuel.

Support for some use of plutonium.--While other countries may call attention to INFCE's conclusions about inalienable rights to use nuclear power and extension of that right to reprocessing and plutonium recycle, they probably would be suspicious of reprocessing and efforts to use plutonium by countries where it makes little economic or technical sense.

Support for uniform controls and conditions for nuclear exports.--Other countries are likely to agree to nuclear export conditions now required by the NPT and by the London Club, but most are unlikely to actively press for the additional conditions imposed by U.S. policy, particularly full scope safeguards and post export controls over transfers and reprocessing (prior rights).

Pressure for reliability of nuclear supply.--Other countries are likely to agree with the United States that nuclear supplies should be reliably and predictably available to states that agree to world non-proliferation commitments. However, the United States will continue to be characterized as unreliable and unpredictable because of the complexity and uncertainties inherent in its policies and their administration for licensing nuclear export, and for U.S. post export controls. The United States can expect pressures to simplify the present U.S. export control system, to make its application more predictable,

and to accomplish any future changes by negotiation rather than declaration of non-negotiable conditions. Similar pressures can be expected for administration of post export controls, particularly for transfer of spent fuel reprocessing.

Pressure for revision of agreements by negotiations.--INFCE is likely to be used by many governments to advance the contention that nuclear cooperation -- required by the Nuclear Non-Proliferation Act -- should involve negotiations rather than unilateral reopening of valid agreements to add new non-negotiable, sometimes retroactive conditions. This can be anticipated in particular for the critical negotiations with Euratom which has become the key log in a logjam of pending renegotiations.

Reliance on institutional ways of limiting proliferation.--INFCE's support for political measures to confine further spread of nuclear weapons, and the concomitant use of institutional measures will make it necessary for the United States to know what it wants to do and how far it wants to go in support for international organizations to store spent fuel and to store plutonium. Similarly, European support for the IAEA's new Committee on Assurances of Supply, with its expected extensive participation by third world states, is likely to generate new pressures on the United States to be a more predictable and reliable nuclear supplier. How to do this without becoming an uncritical or unthinking supplier is a question now on the horizon that will soon be closer at hand.

An optimistic outlook for nuclear energy.--INFCE is likely to be used by other nations as support for their optimism for the future of nuclear power and their policies of expanding use. More third world nations are likely to call for nuclear power as an option, and to charge discrimination if the United States tries to withhold it from them. The viewpoint of the Carter administration that nuclear power is an energy source of last resort will find, it now appears, little international support in the decade of the 80s.